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HAND-BOOK
OF
CYCLONIC STORMS IN THE BAY
OF BENGAL.

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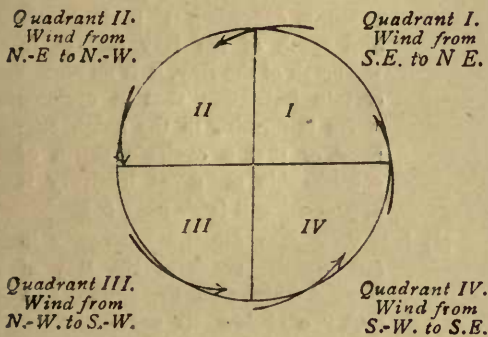
1. Stormy weather in the Bay of Bengal more or less dangerous to shipping may accompany

- (1) Cyclones,
- (2) Cyclonic storms,
- (3) Severe squalls with violent winds.

2. Cyclones and cyclonic storms are both extensive atmospheric whirls in which the air moves cyclonically towards a central area and also tends upwards. The course of the air is hence a species of spiral movement, a combination of indraught and uptake. The direction of the horizontal movement alone concerns sailors.

3. The following diagram shows roughly the general direction of the wind in different parts of a cyclonic circulation in the Bay of Bengal :—

FIG. 1.



The air hence moves round in the direction opposite to the movement of the hands of a watch or counter clockwise.

4. A cyclone is the most violent and extensive class of storm occurring in the Bay of Bengal. It is a cyclonic circulation consisting of :—

- (1) An outer area of slight to moderate fall of the barometer and of wind force ranging from 6 to 9.
- (2) An inner area of rapid barometric change and of violent winds force 10 to 12.
- (3) A central area of calms or light winds and tempestuous sea.

5. A cyclonic storm is a vigorous cyclonic circulation in which the winds range up to force 8, 9 or 10. The barometer falls to a moderate extent, usually not more than three or four-tenths of an inch, on passing from the outskirts to the centre.

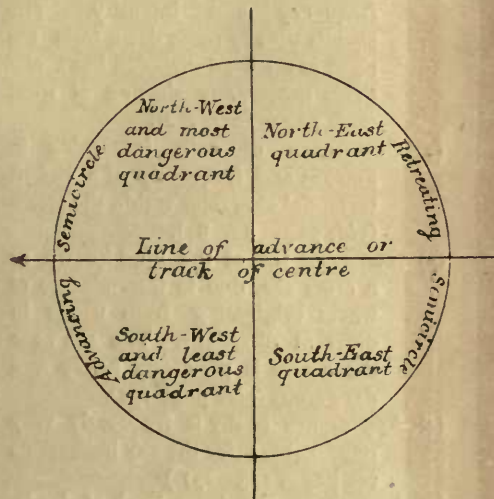
6. Cyclones and cyclonic storms in the Bay may be divided into two classes :—

- (1) Those which advance along westerly tracks (*i.e.*, between west and north-west).
- (2) Those which advance along northerly tracks (*i.e.*, between north-west and north-east).

7. Cyclonic areas are divided for reference into quadrants and semicircles. The front half of a storm is usually called the advancing semicircle and the half in the rear, the retreating semicircle. The quadrants formed by the line of advance of the centre and a line at right-angles may be numbered in order counter clockwise, I, II, III and IV as in Fig. 1. One of these quadrants is the most dangerous and the most difficult for a ship to extricate herself from and another is the least dangerous. These storms are usually somewhat elliptical in shape but for convenience are usually as charted from barometric observations represented as circular.

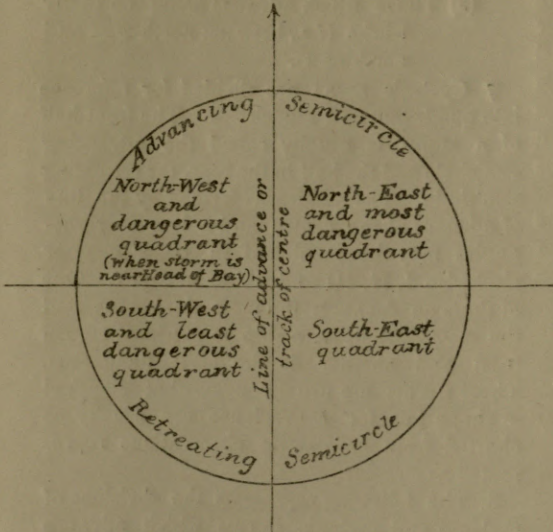
8. The following represents the divisions of cyclones and cyclonic storms which advance along westerly tracks (*i.e.*, between west and north-west) into semicircles and quadrants.

FIG. 2.



9. The following gives similar information for storms which advance along northerly tracks (north-west to north-east) :—

FIG. 3.



10. Indications of approach of, or entrance into, cyclones or cyclonic storms.

These are :—

- (1) Occurrence of squalls increasing in frequency and intensity. The squalls usually come down from the right of the wind direction but sometimes accompany shifting of wind (*vide* pages 201—202).
- (2) Occurrence of rain increasing in amount and frequently of a violent torrential character within the storm (*vide* pages 82—84).
- (3) Increasing sea, of the kind known as a cross sea, due to intermixture of waves originating from winds in different directions. The sea near the centre is peculiarly heavy and dangerous (*vide* page 151).
- (4) Appearance of sky is frequently very remarkable : (for the sky indications see pages 135—137.)
- (5) Appearance of a dense bank of clouds, dome-shaped and more or less permanent. This is frequently one of

the earliest indications in the north of the Bay (*vide* pages 131 to 135).

- (6) The barometer falls in passing from the outskirts into the storm area. The fall is slight in the outskirts of storms, but increases more and more rapidly as the centre is approached. The two following rules based on observations are laid down in the Handbook for guidance of sailors in the Bay :—

(a) If the barometer in the Bay of Bengal during the cyclonic season lasting from May to December falls more than '15" in the north of the Bay, or more than '1" in the centre or south of the Bay in 24 hours, that is, if the difference between the reading of the barometer at the same place and at the same hour on two consecutive days differs by amounts exceeding '1" in the centre and south of the Bay or '15" in the north of the Bay, it is an almost certain indication that a cyclonic storm is forming in the neighbourhood, or that a cyclonic storm of considerable or great intensity is approaching it (*vide* page 66).

- (b) It is very rare for the barometer to fall in the north of the Bay of Bengal more than two-tenths of an inch ('20") below its normal height or more than '15" in the centre of the Bay, and if it does so on board a ship in the north or centre of the Bay, it is an almost certain indication that a cyclonic storm has formed, or is forming, in the Bay, the position of which can be ascertained from other indications (*vide* page 67).

- (7) Shift of wind, in accordance with the rotation of winds in moving cyclonic whirls.

11. When the barometer, wind and other indications and the sky appearances indicate the approach of a cyclonic storm or cyclone it is necessary to ascertain :—

- (1) The probable direction and distance of the storm centre.
- (2) The probable track of the storm centre
- (3) The probable extent and intensity of the storm.

12. The indications for each of these are as follows :—

Probable bearing of the centre—

This is ascertained :—

- (a) From the wind direction, for which the rule is to face the wind exactly, and the centre will be on your right hand and from ten to eleven points from the direction whence the wind comes (*vide* pages 193–195).
- (b) From the direction of the sea or swell, which roughly coincides with the direction of the storm centre in the northern and western quadrants.
- (c) By the direction of the densest part of the huge bank of clouds, frequently seen when approaching and entering a cyclonic storm from the north.

Probable track of storm centre.—

This is ascertained by the following :—

- (a) By slowing ship down and waiting for shift of wind. The change of wind will give sufficient indication from which roughly direction of storm may be determined by reference to the table, pages 201–202.
- (b) By comparison with storm tracks of the month given in plates XXI to XXVI and XXVIII to XXXV.

A reference to these charts will show that in some months storms follow almost invariably one general track. The following is a very brief summary of the known facts :—

January to March.—Cyclonic storms practically unknown in the Bay.

April.—Storm tracks are westerly to the Ceylon or Coromandel Coast or northerly to Burma or Arakan Coast.

May.—Storm tracks are westerly to Coromandel Coast or northerly to Bengal or Arakan Coast.

June.—Storm tracks are westerly to Orissa Coast or northerly to Bengal Coast.

July.—Storm tracks are north-north-westerly to westerly to Orissa Coast, *i.e.*, between Saugor Island and Gopalpur.

August.—Storm tracks are westerly to Orissa Coast or northerly to Bengal Coast.

September.—Storm tracks are somewhat irregular but chiefly westerly to Orissa or Ganjam Coast.

October.—Storm tracks are very irregular.

November.—Storm tracks are irregular.

December.—Storm tracks are westerly to South Coromandel Coast.

The most dangerous months are hence October and November when the storms are most vigorous and intense and also most erratic in their movement.

Intensity and extent of storm.—The chief indications are :—

- (1) Rate of fall of barometer in outer storm area.
- (2) Rate of increase of winds in outer storm area.
- (3) Strength of sea and cross swell.
- (4) Sky appearances.
- (5) Comparison with previous experience of same month or season. (Consult the rules or indications, pages 165 to 183.

13. *The following points require the special consideration of sailors in storms of the Bay, more especially as it is not easy to give definite rules :—*

- (1) *Probable recurvature of storms.*
- (2) *Character of winds in the north-west quadrant of storms marching to the Orissa or West Bengal Coast.*
- (3) *Direction of winds in line of advance of storm with occasionally little or no shift of wind.*

- (1) **Recurvature of storm.**—Recurvature occurs chiefly in storms advancing northwards in May, October and November and is almost invariably to east.

Indication—

The rate of advance usually decreases whilst the storm is recurving, the decrease of the rate increasing with the amount of recurvature. The indication is of little value at sea as it is rarely possible to ascertain the rate of advance with precision.

- (2) **Winds in the north-west angle of Bay.**—These winds in the most dangerous cyclone months (October and November) are frequently during the approach of storms practically the same in direction as the normal winds of season, *i.e.*, from north-west or north-east.

The chief features which serve to warn mariners that these winds may be

cyclonic and not the normal winds of the season are :—

- (a) The occurrence of increasing swell.
- (b) Great and remarkable clearness of the atmosphere, which is a very noteworthy feature in front of these storms.
- (c) The appearance of a well defined and persistent bank of clouds to the south.

(3) **Winds in track of advancing storm.**—If a vessel is in front of the track of a cyclone the shift of winds is small and may be practically *nil*. Hence if other appearances indicate an approaching cyclone the absence of a shift of wind in the north-west or north quadrant is usually an indication that the storm centre is approaching directly to the vessel or place of observation.

14. *When the captain of a vessel in the Bay has ascertained the existence and position of a cyclonic storm likely to give him bad weather he should next modify his course as follows:—*

- (1) *If possible to keep outside the storm.*
- (2) *If this be not possible he should at least navigate his vessel so as to avoid the most dangerous parts, i.e.*
 - (a) *The calm centre.*
 - (b) *The inner area of violent or hurricane winds.*
 - (c) *The dangerous quadrant or semicircle.*

15. In case of cyclonic storms marching westwards the north-west quadrant (*vide* Fig. 2) is the most dangerous quadrant and in the case of storms marching northwards (*vide* Fig. 3) the north-east is the most dangerous. The north-west is also dangerous when the storm is approaching the head of the Bay.

16. The chief rules usually laid down to guide mariners to avoid the more serious risks and dangers of cyclones and cyclonic storms in the Bay of Bengal are—

- (1) Never cross in front of a cyclonic storm unless the centre is so far off that it is certain the vessel will pass into the least dangerous quadrant before the approach of the storm.
- (2) If in the River Hooghly remain at

anchor in the river if a cyclone is travelling northward.

- (3) Steamer entering into or finding herself within the outer area of a cyclone or in a cyclonic storm should be manœuvred so as to increase her distance from the centre without delay.
- (4) If a steamer is in the open sea and finds herself in the dangerous semicircle she should generally steam slowly against the wind or with the wind on her starboard bow.
- (5) If vessel be lying at anchor on the Madras Coast or proceeding along that coast and the centre of a severe cyclonic storm be approaching directly towards that part of the coast, she ought especially to avoid passing into the right hand semicircle and proceed south or south-south-east, so as to avoid the storm. The winds near the coast and the sea in the left advancing quadrant are in this case comparatively light, and there is little or no danger from currents. If in the right advancing or north-west quadrant, the commander of the vessel ought to judge of his position as early as possible and proceed well out into the open and keep as far north as is advisable considering his proper course, and then, if proceeding southwards, pass round the storm in the east quadrant.

The following additional rules are given for sailing ships :—

- (6) If the vessel be in the right hand semicircle of a cyclone or cyclonic storm, heave to on the starboard tack. If in the left hand semicircle run, keeping the wind on the starboard quarter, if possible. When the squalls decrease and the barometer rises, if necessary, heave to on the port tack if it is desired not to proceed too far from the proper course.
- (7) It is sometimes not expedient to run in the manageable or left hand semicircle, in which case it is usual to heave to on the port tack.



HAND-BOOK

OF

CYCLONIC STORMS IN THE BAY OF BENGAL.

FOR THE USE OF SAILORS.

VOL. II—PLATES

BY

JOHN ELIOT, M.A., F.R.S., C.I.E.,

METEOROLOGICAL REPORTER TO THE GOVERNMENT OF INDIA AND
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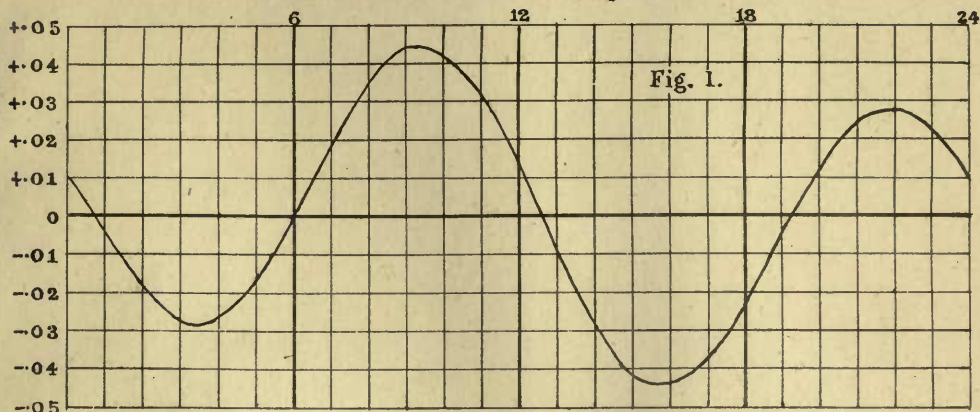
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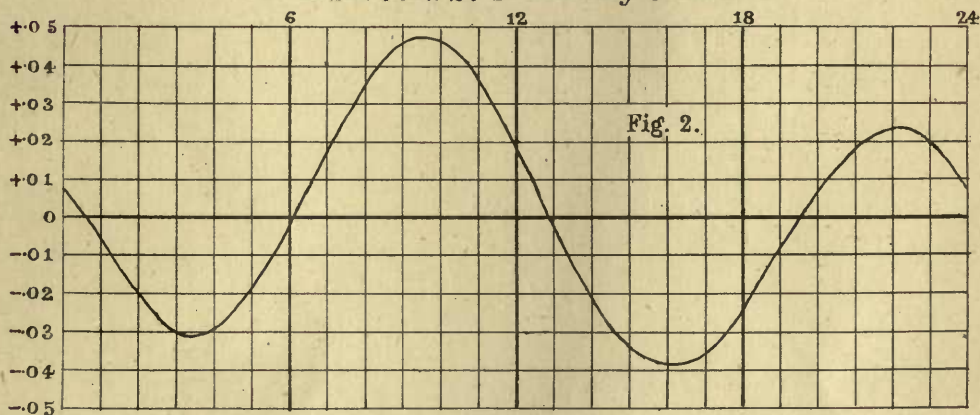
CURVE SHEWING MEAN DIURNAL OSCILLATION OF
BAROMETER IN BAY OF BENGAL.

From Lat. 0° to 10° N. and Long. 80° to 90° E.



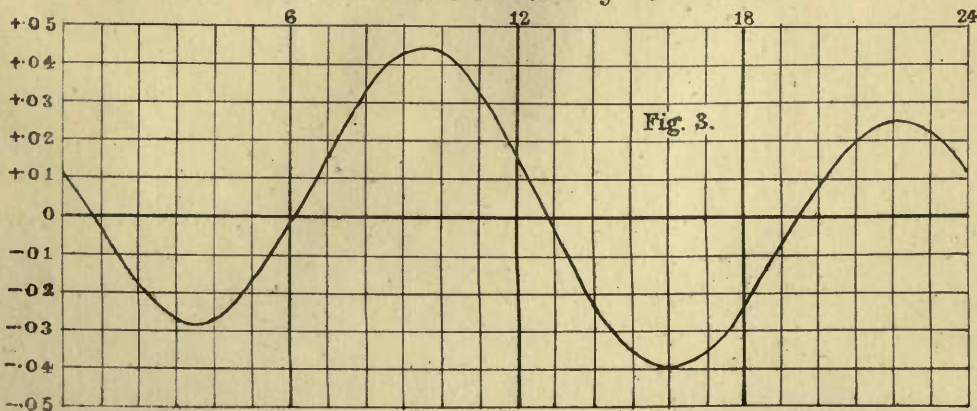
CURVE SHEWING MEAN DIURNAL OSCILLATION OF
BAROMETER IN BAY OF BENGAL.

From Lat. 10° to 20° N. and Long. 80° to 90° E.



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BAROMETER IN BAY OF BENGAL.

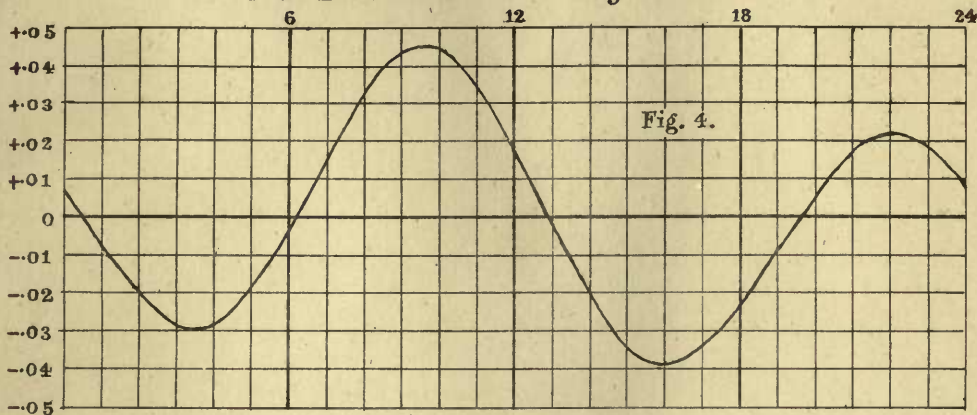
From Lat. 0° to 20° N. and Long. 90° to 100° E.





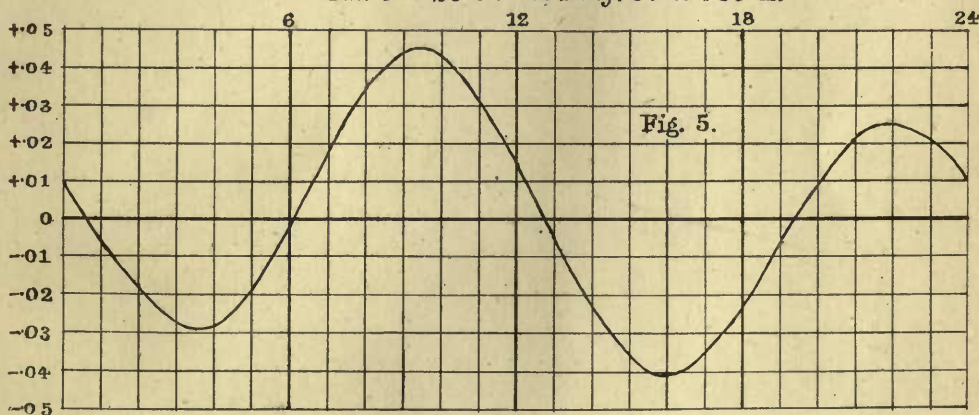
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**CURVE SHEWING MEAN DIURNAL OSCILLATION OF
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From Lat. 0° to 20° N. and Long. 80° to 100° E.





MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF JANUARY IN BAY OF BENGAL

EXPLANATION.

Winds are represented by arrows pointing to the direction towards which air is moving. Except in four plates the force of the wind in Beaufort notation is denoted by the number of feathers attached to the arrows, a short feather denoting half. Thus three long feathers and a short feather denote wind force 3.5 & so on.

The general direction of the currents is represented by long curved arrows in broken lines pointing in the direction towards which the water is moving and the mean velocity is given in miles per hour. (e. g. 2 miles).

JANUARY.

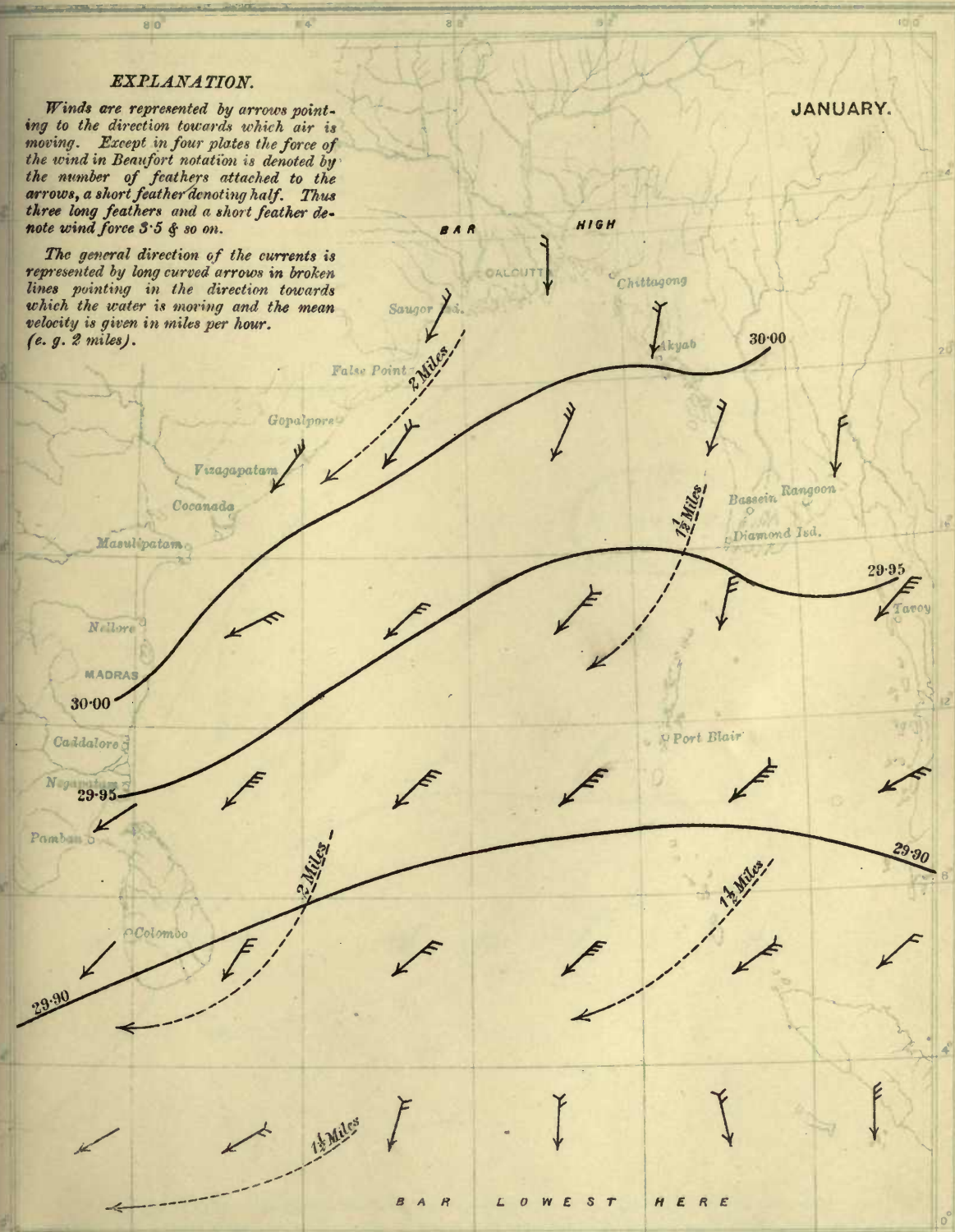


PLATE III
FIGURE 1
A. A. BAROMETRIC HEIGHT MEASURED TO BEARER'S EYE AND CONSTANT GRAVITY AT
LAT. 42° 45' N. LONG. 122° 45' W. AND NEAR CURRENT OBSERVATION
FOR MONTH OF JANUARY IN BAY OF ST. JAMES

JANUARY

EXPLANATION
The line shows the height of the water surface above the mean low water level of the tide. The line is drawn from the observations of the barometer and the height of the water surface above the mean low water level of the tide. The line is drawn from the observations of the barometer and the height of the water surface above the mean low water level of the tide.



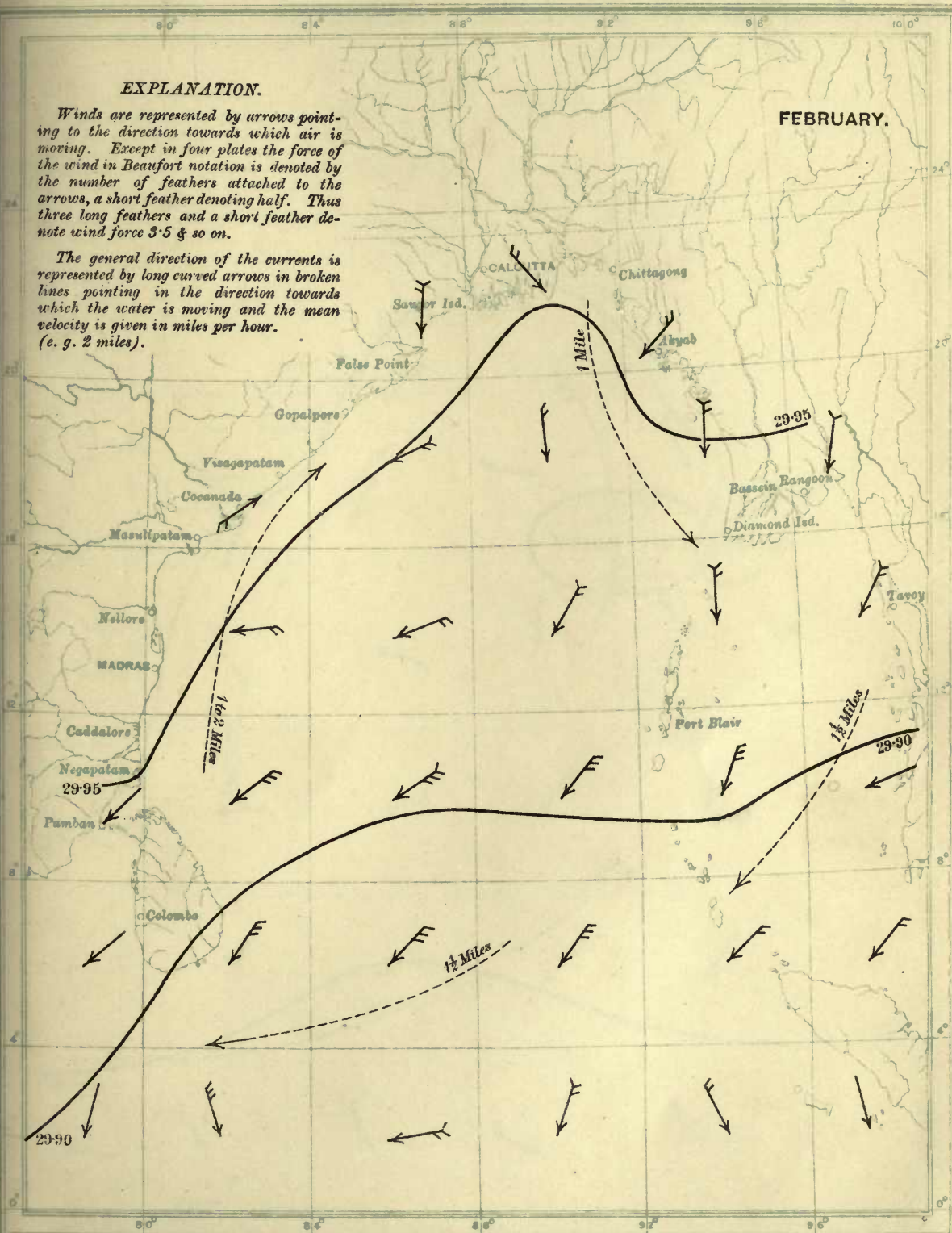
MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF FEBRUARY IN BAY OF BENGAL.

EXPLANATION.

Winds are represented by arrows pointing to the direction towards which air is moving. Except in four plates the force of the wind in Beaufort notation is denoted by the number of feathers attached to the arrows, a short feather denoting half. Thus three long feathers and a short feather denote wind force 3·5 & so on.

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FEBRUARY.



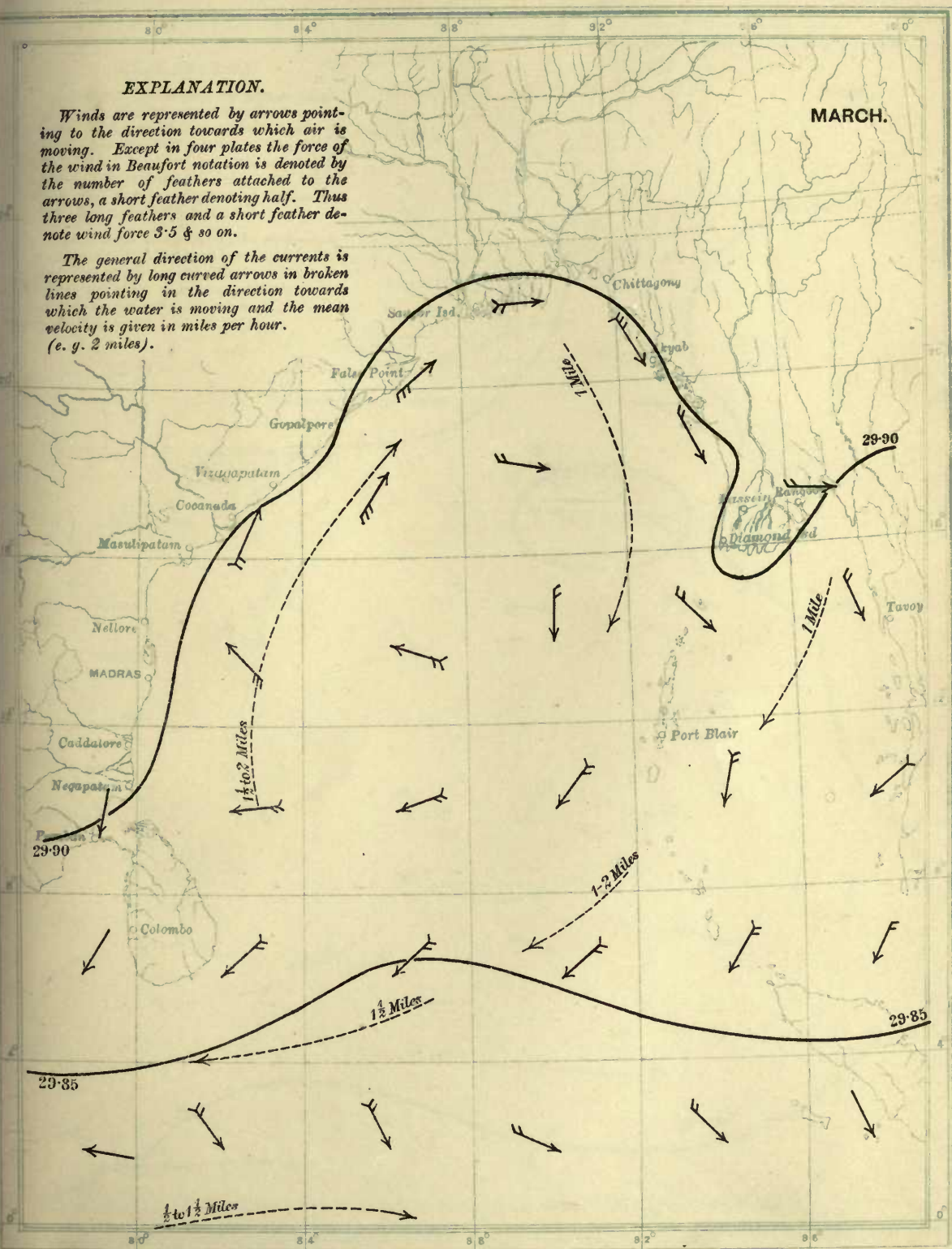
MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF MARCH IN BAY OF BENGAL.

EXPLANATION.

Winds are represented by arrows pointing to the direction towards which air is moving. Except in four plates the force of the wind in Beaufort notation is denoted by the number of feathers attached to the arrows, a short feather denoting half. Thus three long feathers and a short feather denote wind force 3.5 & so on.

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MARCH.





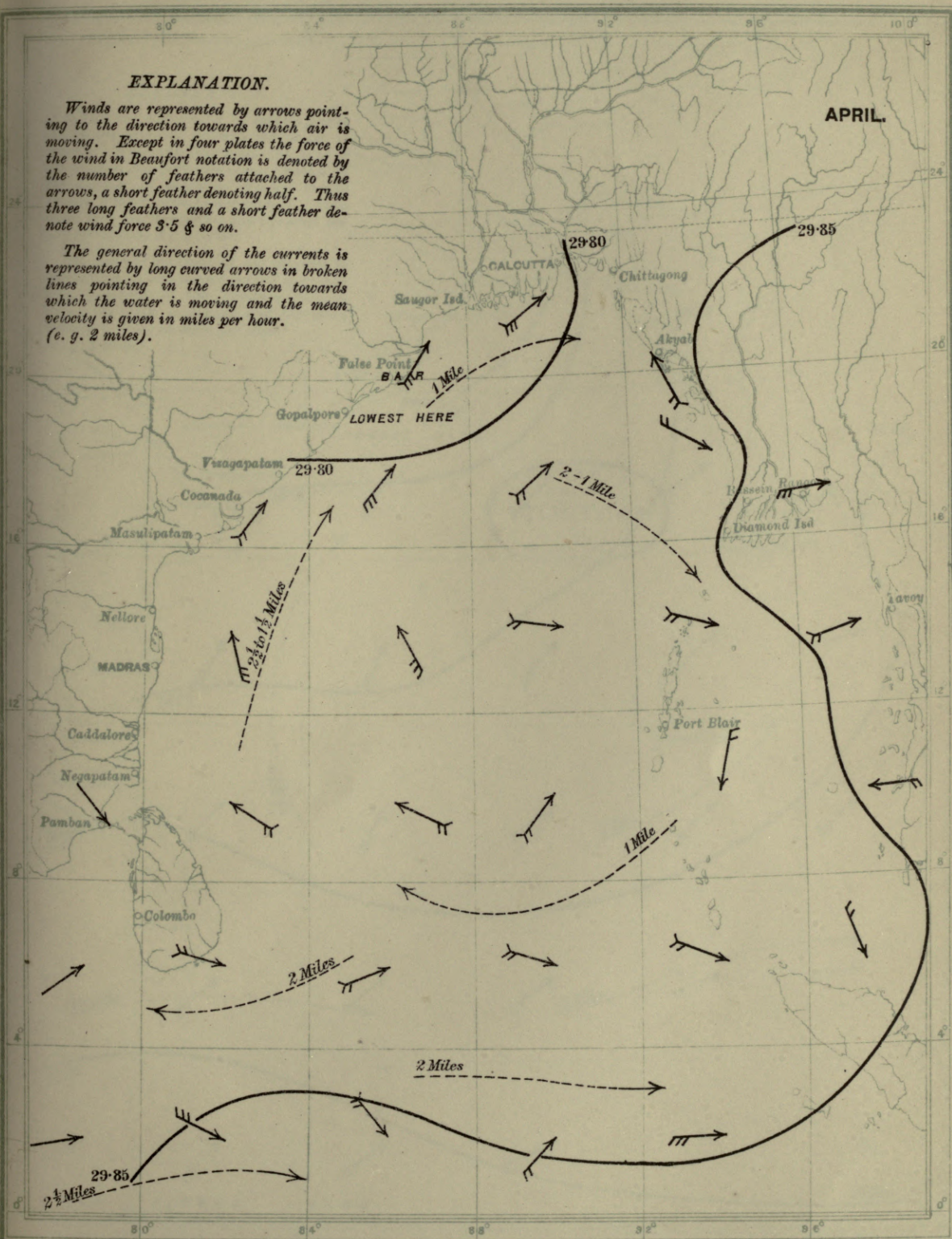
MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 46°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF APRIL IN BAY OF BENGAL

EXPLANATION.

Winds are represented by arrows pointing to the direction towards which air is moving. Except in four plates the force of the wind in Beaufort notation is denoted by the number of feathers attached to the arrows, a short feather denoting half. Thus three long feathers and a short feather denote wind force 3.5 & so on.

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APRIL.



U. S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
BULLETIN 111
PUBLISHED BY THE GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
1905

111

THE following is a list of the names of the persons who have been employed by the U. S. Geological Survey during the year 1905. The names are arranged in alphabetical order, and the number of months each person has been employed is given in parentheses. The names of the persons who have been employed for less than six months are given in italics. The names of the persons who have been employed for six months or more are given in bold type.



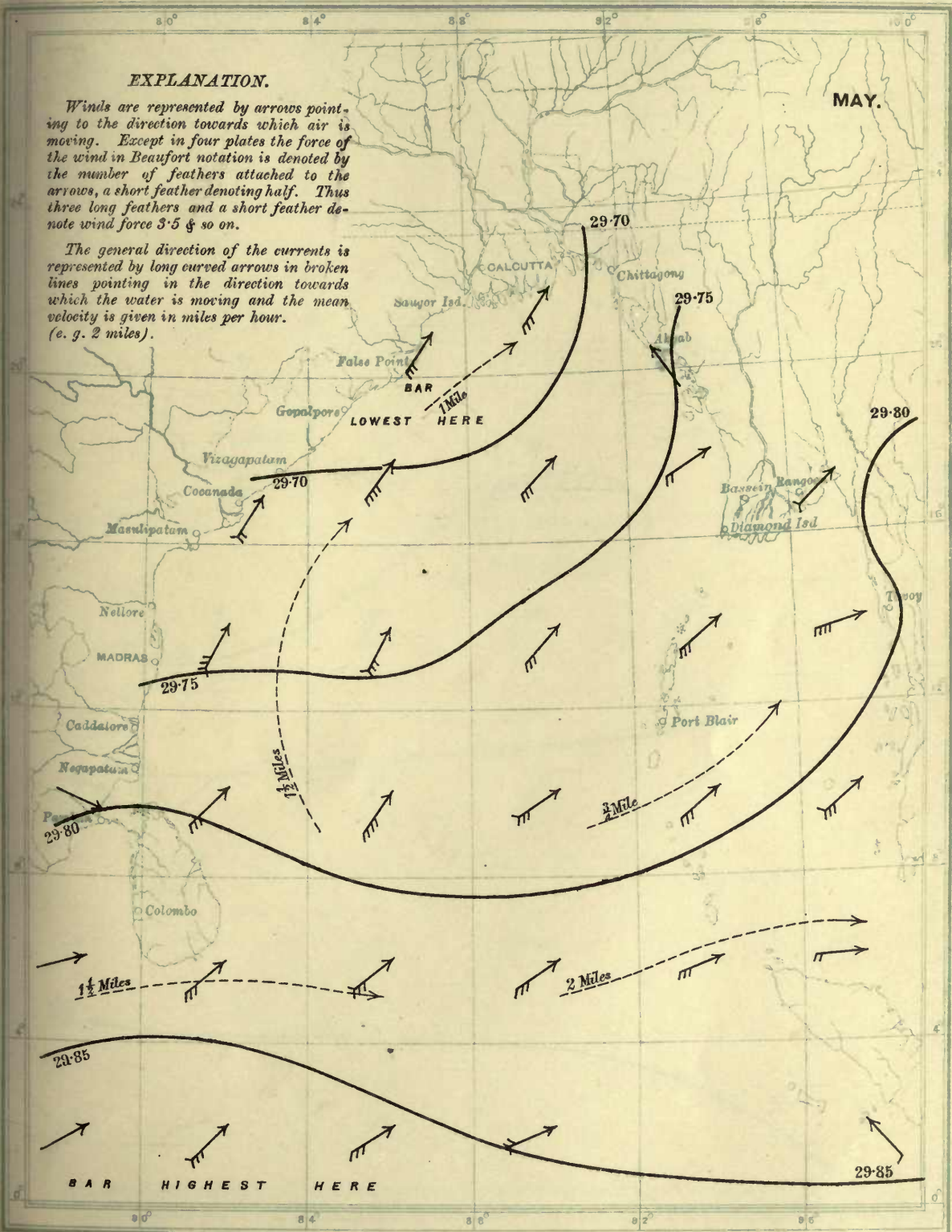
MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF MAY IN BAY OF BENGAL.

EXPLANATION.

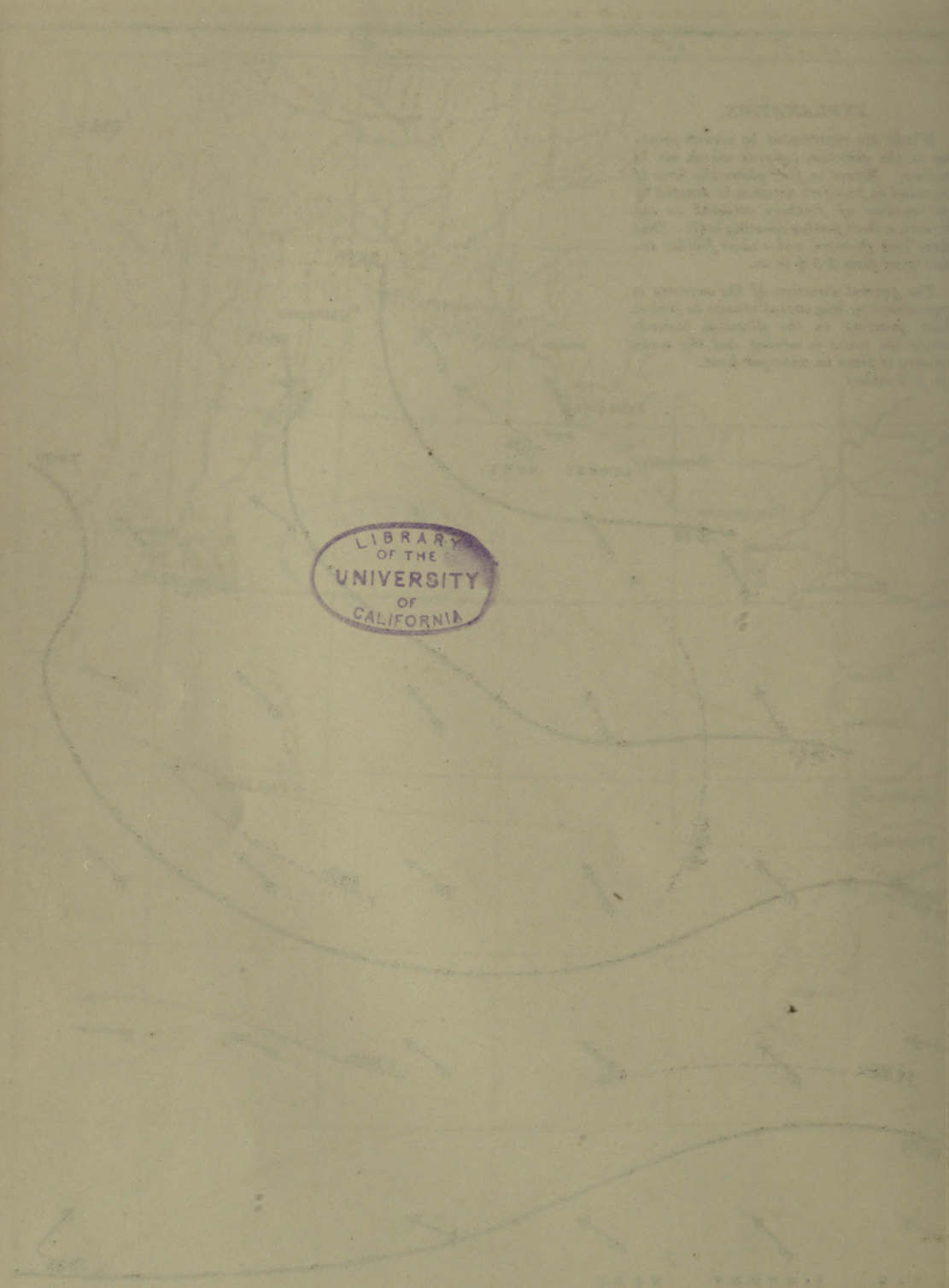
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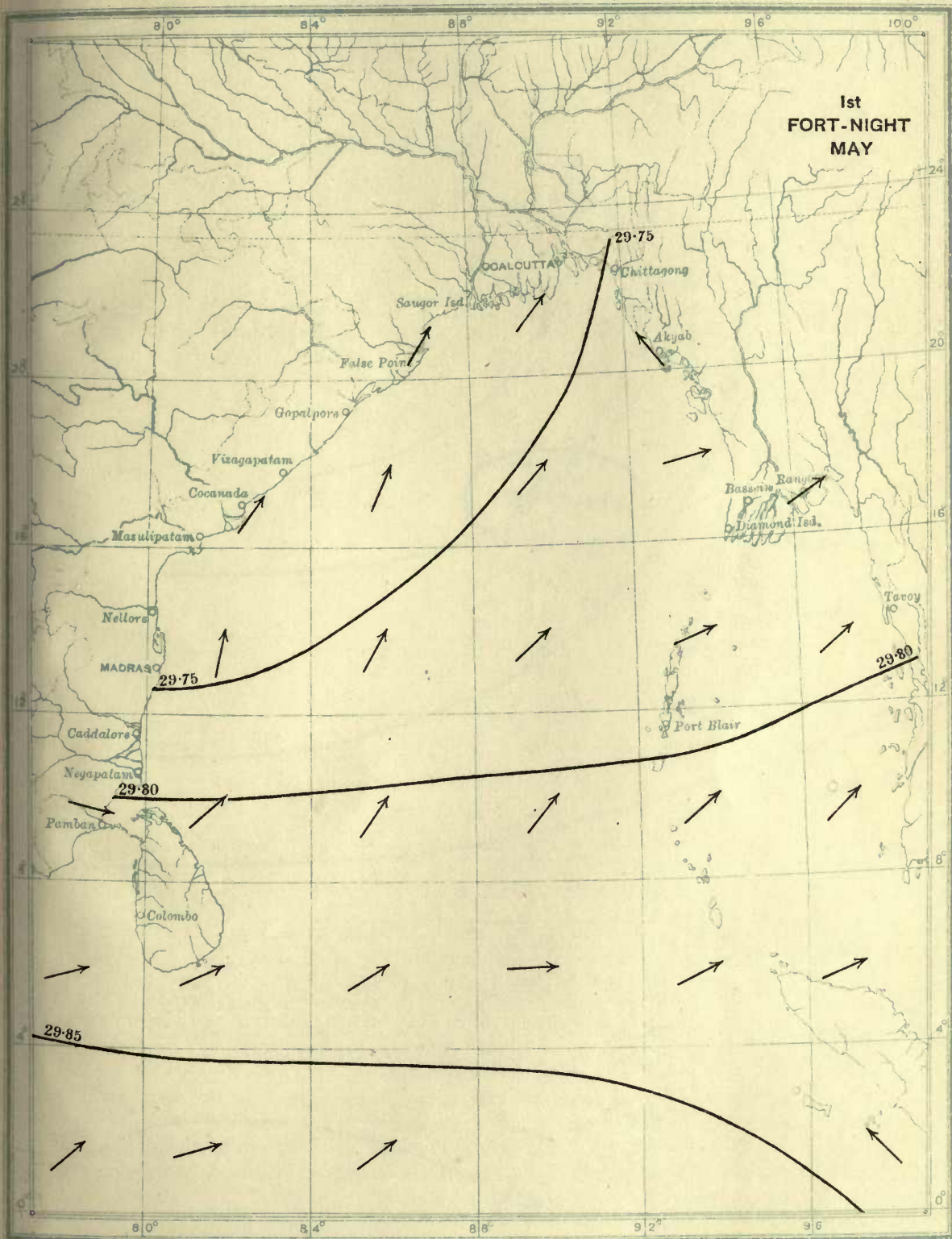
MAY.



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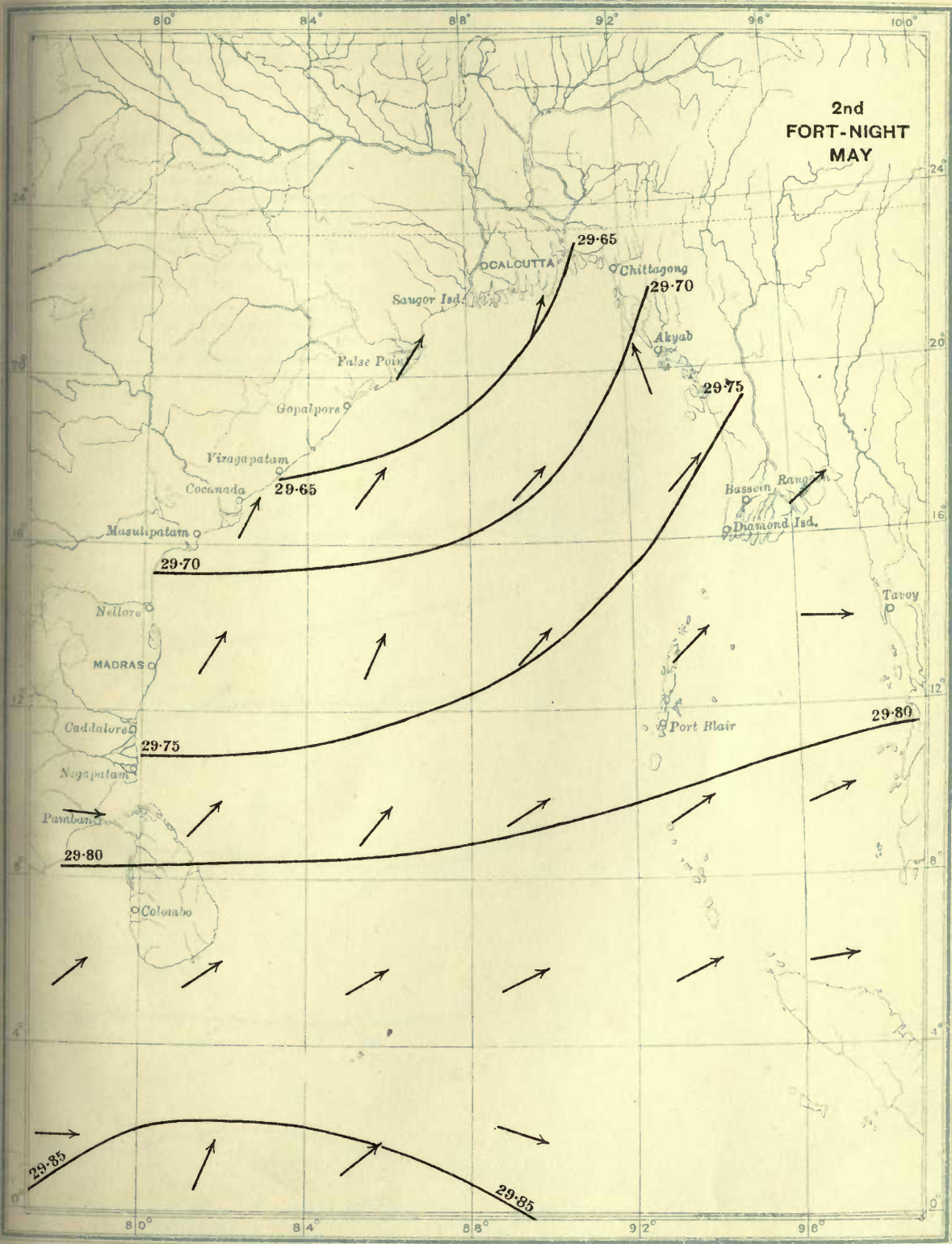


MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, AND MEAN DAILY WIND DIRECTION FOR FIRST FORT-NIGHT OF
MAY IN BAY OF BENGAL.





MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, AND MEAN DAILY WIND DIRECTION FOR SECOND FORT-NIGHT OF
MAY IN BAY OF BENGAL



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THE
FEDERAL
MAP



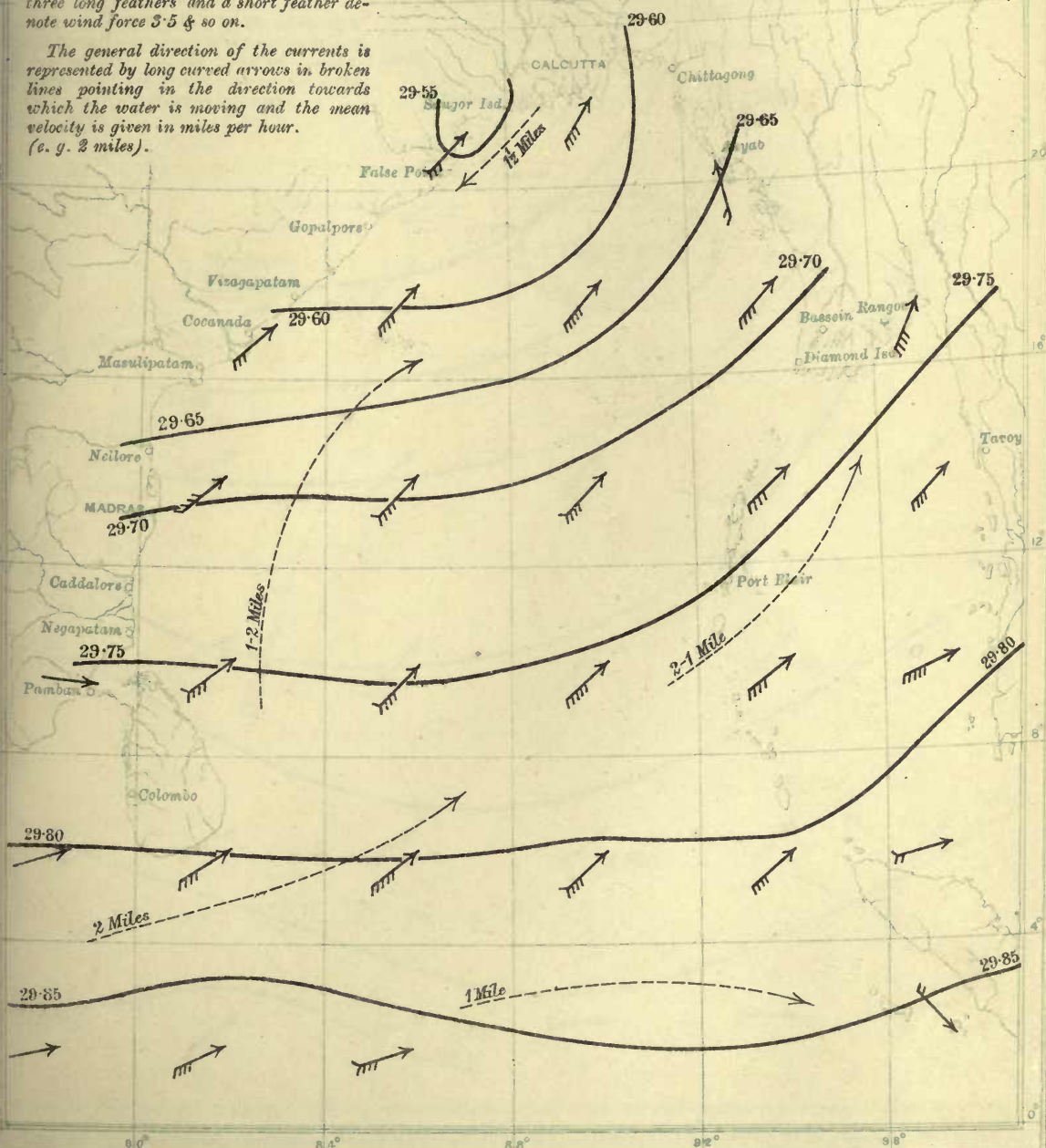
MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF JUNE IN BAY OF BENGAL.

EXPLANATION.

Winds are represented by arrows pointing to the direction towards which air is moving. Except in four plates the force of the wind in Beaufort notation is denoted by the number of feathers attached to the arrows, a short feather denoting half. Thus three long feathers and a short feather denote wind force 3.5 & so on.

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JUNE.



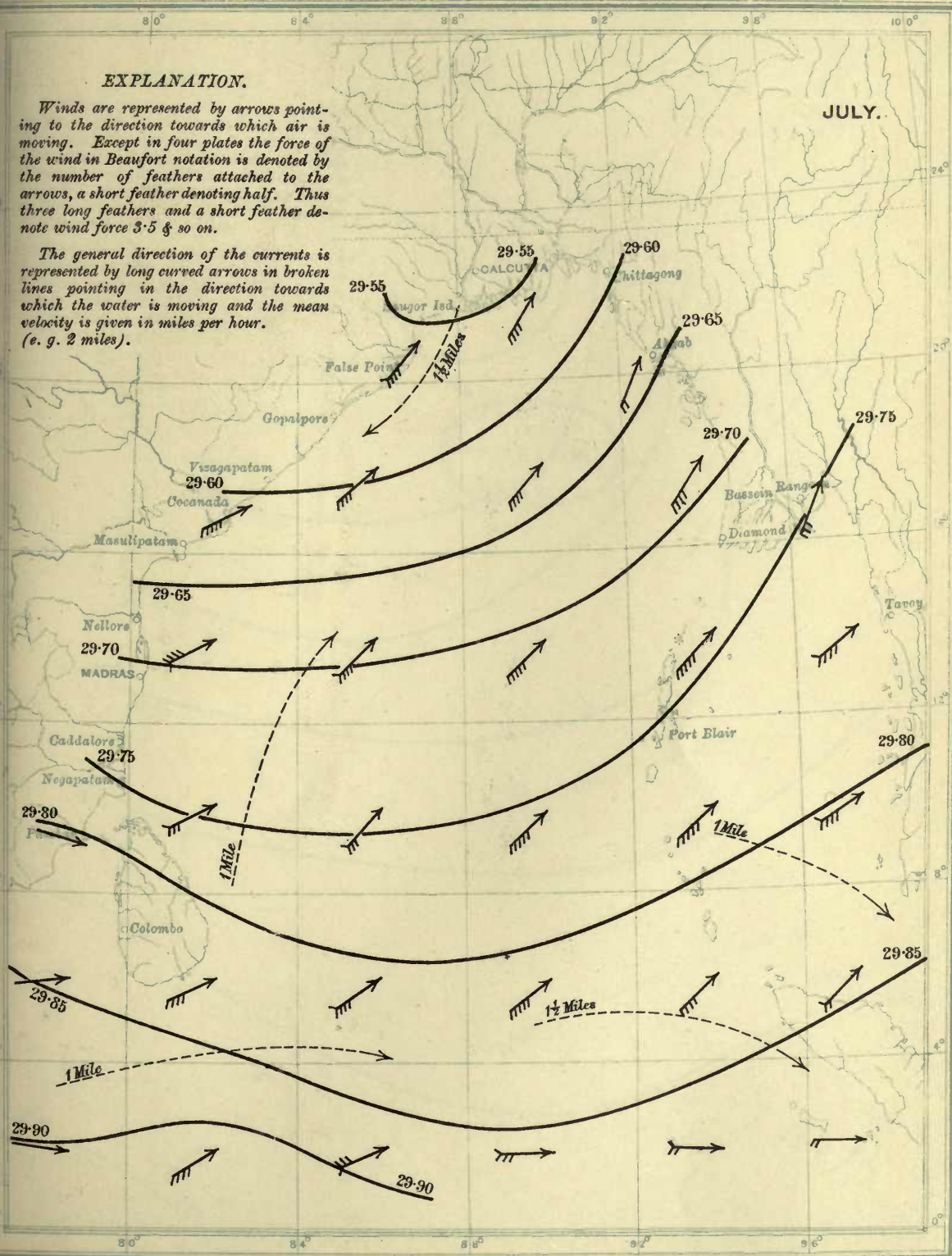


MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF JULY IN BAY OF BENGAL.

EXPLANATION.

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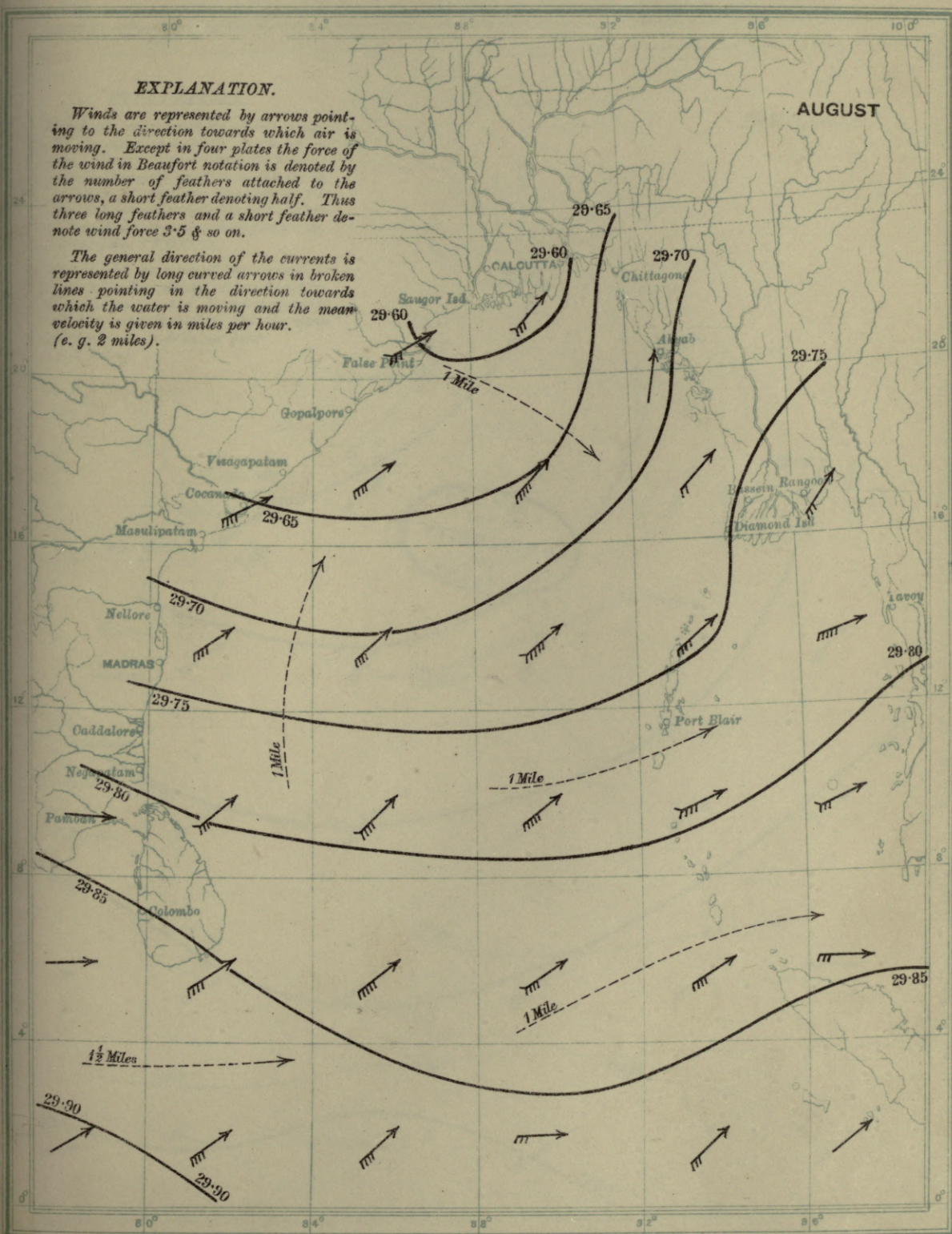


MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF AUGUST IN BAY OF BENGAL.

EXPLANATION.

Winds are represented by arrows pointing to the direction towards which air is moving. Except in four plates the force of the wind in Beaufort notation is denoted by the number of feathers attached to the arrows, a short feather denoting half. Thus three long feathers and a short feather denote wind force 3·5 & so on.

The general direction of the currents is represented by long curved arrows in broken lines pointing in the direction towards which the water is moving and the mean velocity is given in miles per hour. (e. g. 2 miles).





MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF SEPTEMBER IN BAY OF BENGAL.

EXPLANATION.

Winds are represented by arrows pointing to the direction towards which air is moving. Except in four plates the force of the wind in Beaufort notation is denoted by the number of feathers attached to the arrows, a short feather denoting half. Thus three long feathers and a short feather denote wind force 3·5 & so on.

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SEPTEMBER.

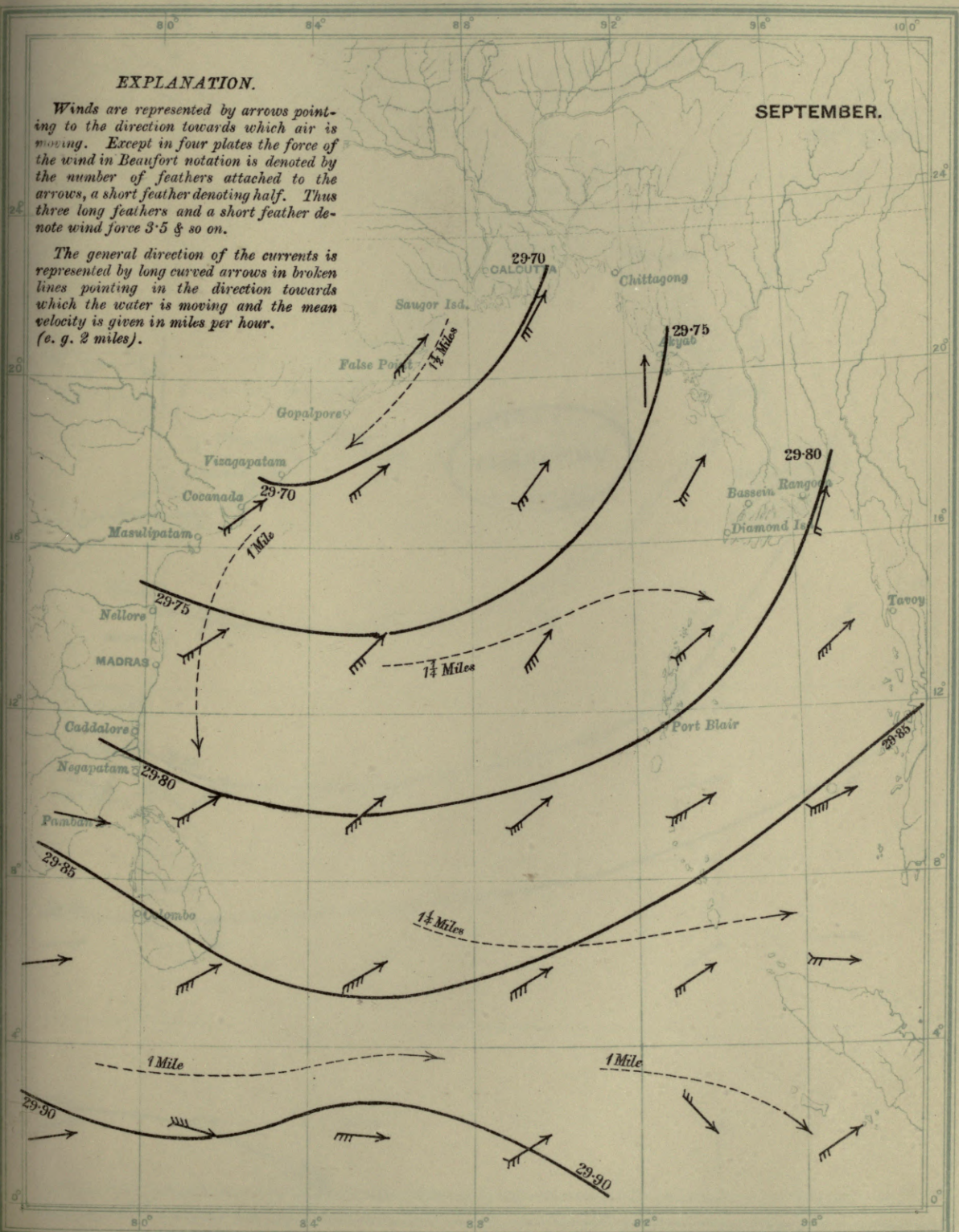


FIG. 2. A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT DENSITY AT
LAT. 22, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF SEPTEMBER IN BAY OF BENGAL.

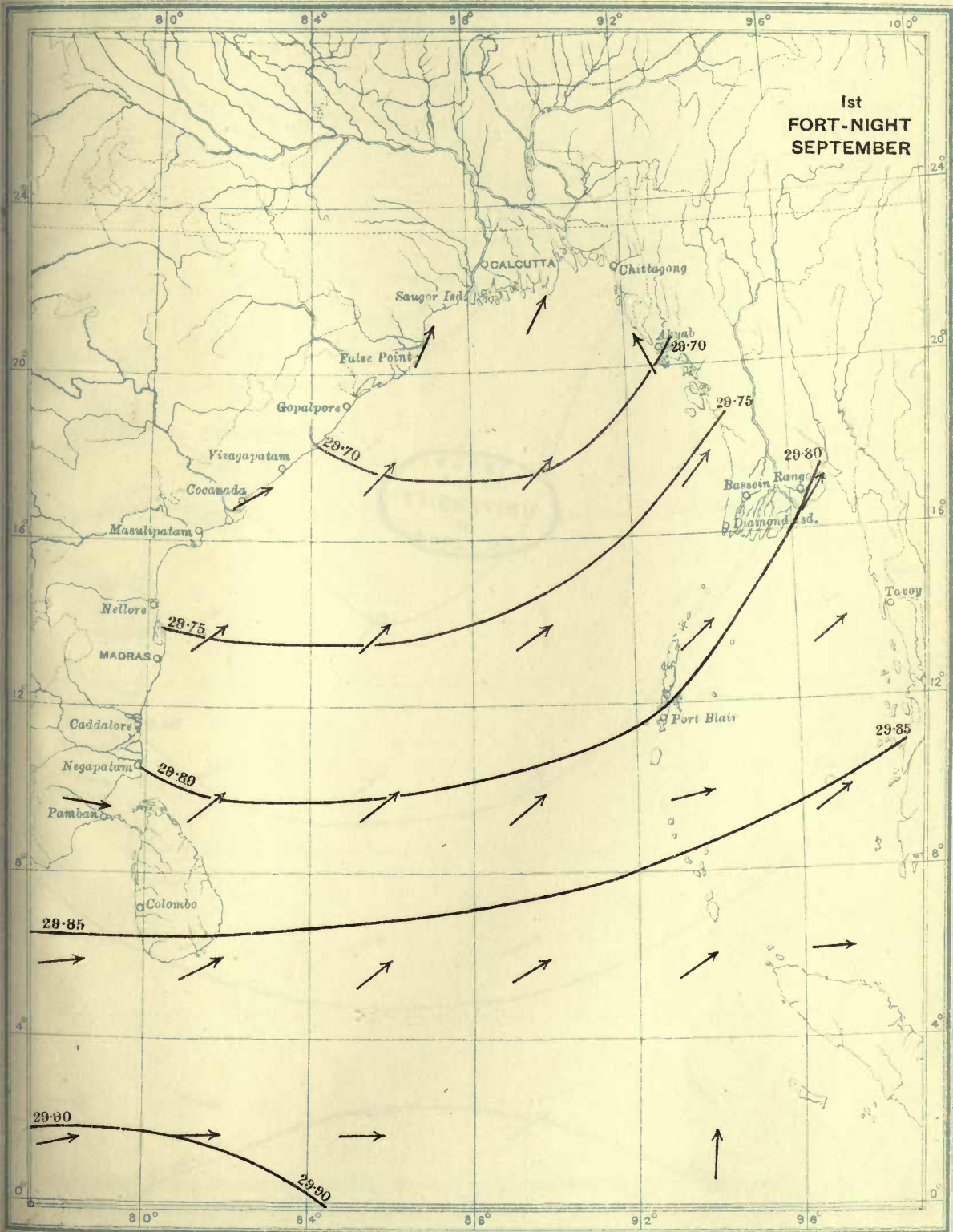
SEPTEMBER

REMARKS

When the wind is light and the barometer is steady, the weather is generally fair. When the wind is strong and the barometer is falling, the weather is generally stormy. When the wind is light and the barometer is falling, the weather is generally squally. When the wind is strong and the barometer is steady, the weather is generally heavy.



MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, AND MEAN DAILY WIND DIRECTION FOR FIRST FORT-NIGHT OF
SEPTEMBER IN BAY OF BENGAL.

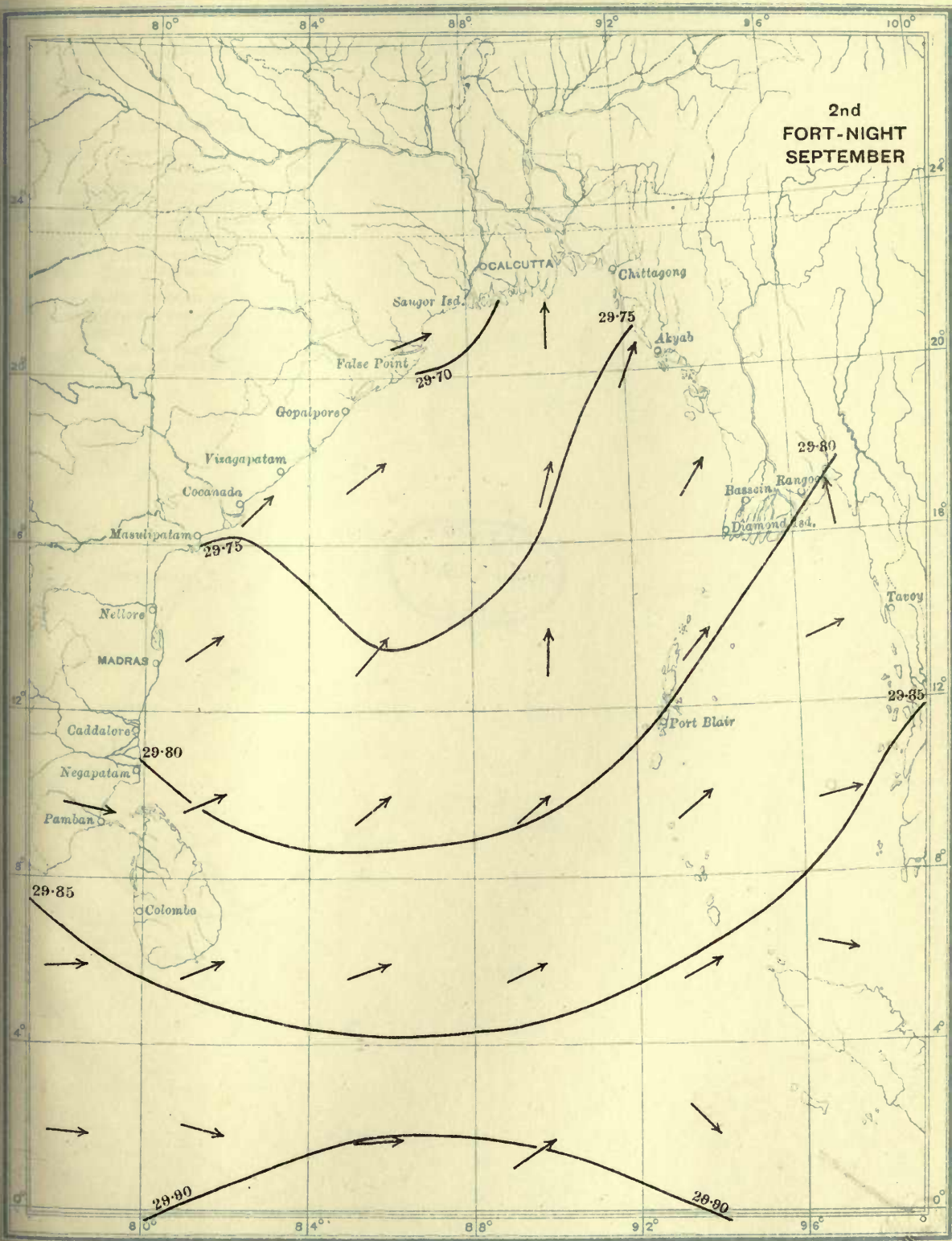


PLAN 6 A. A. BATHOMETRIC SURVEY RECORDED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 42° 15' 00" N. LONG. 122° 00' 00" W. FOR FORT-NIGHT OF
SEPTEMBER IN BAY OF BERNARD.

FORT-NIGHT
SEPTEMBER



MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, AND MEAN DAILY WIND DIRECTION FOR SECOND FORT-NIGHT OF
SEPTEMBER IN BAY OF BENGAL.





MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF OCTOBER IN BAY OF BENGAL.

EXPLANATION.

Winds are represented by arrows pointing to the direction towards which air is moving. Except in four plates the force of the wind in Beaufort notation is denoted by the number of feathers attached to the arrows, a short feather denoting half. Thus three long feathers and a short feather denote wind force 3.5 & so on.

The general direction of the currents is represented by long curved arrows in broken lines pointing in the direction towards which the water is moving and the mean velocity is given in miles per hour. (e.g. 2 miles).

OCTOBER.

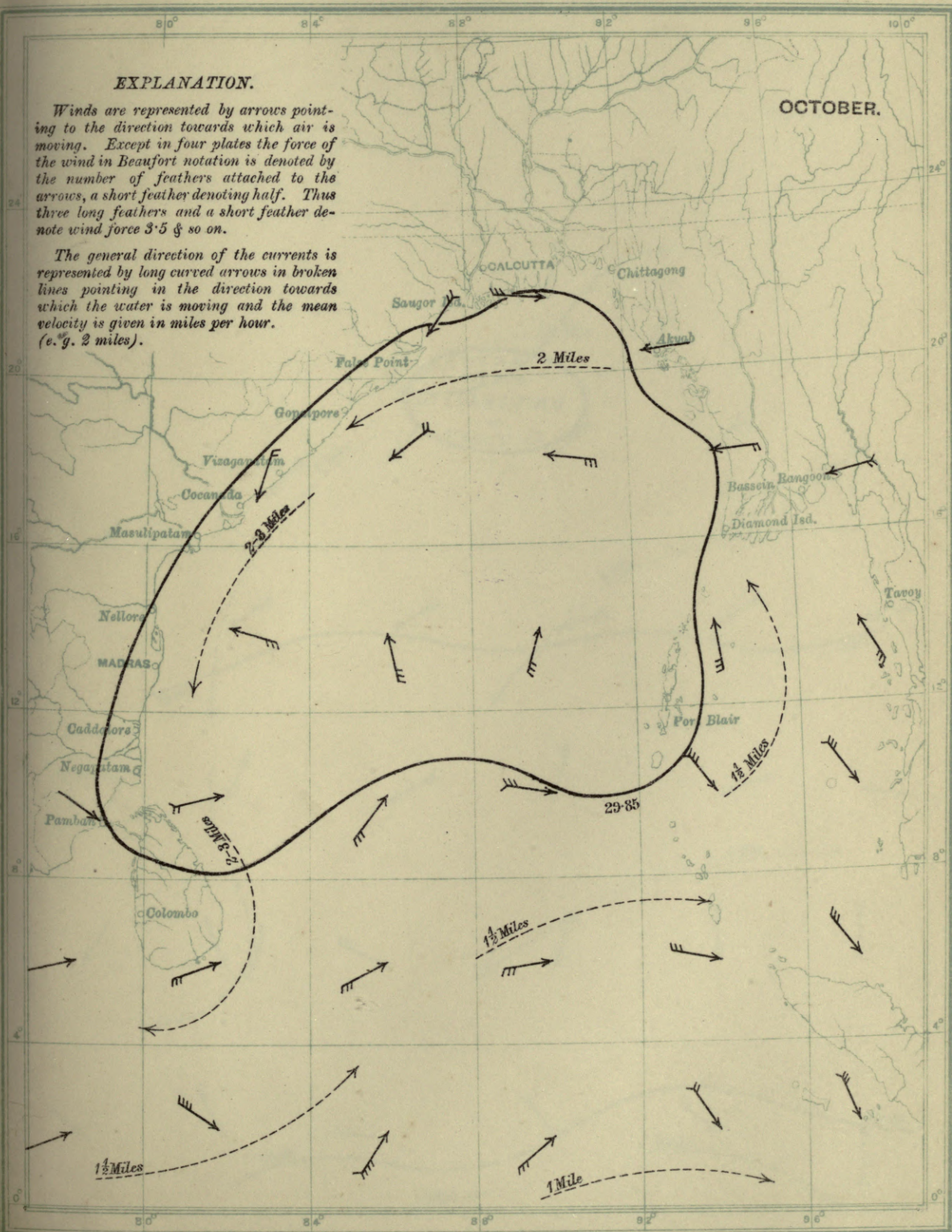


Plate XVI

View of the Gulf of Mexico from the shore

THESE ARE A. A. HARRINGTON'S PHOTOGRAPHS OF THE GULF OF MEXICO, TAKEN AT
LATE 1891, EARLY 1892, AND 1893, AND ARE THE PROPERTY OF THE
U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C.

October

October

THESE ARE A. A. HARRINGTON'S PHOTOGRAPHS OF THE GULF OF MEXICO, TAKEN AT
LATE 1891, EARLY 1892, AND 1893, AND ARE THE PROPERTY OF THE
U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C.



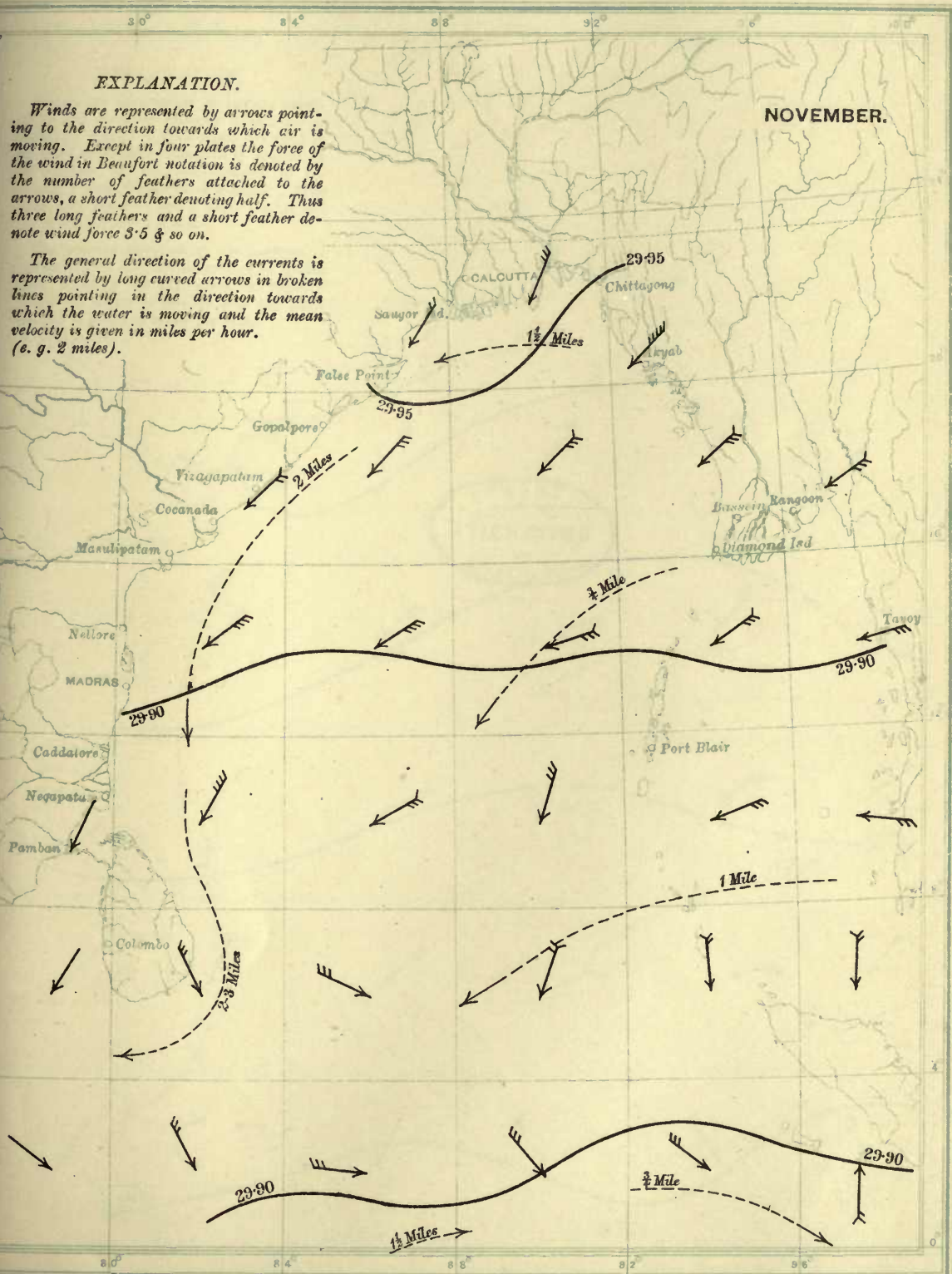
MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF NOVEMBER IN BAY OF BENGAL

EXPLANATION.

Winds are represented by arrows pointing to the direction towards which air is moving. Except in four plates the force of the wind in Beaufort notation is denoted by the number of feathers attached to the arrows, a short feather denoting half. Thus three long feathers and a short feather denote wind force 3.5 & so on.

The general direction of the currents is represented by long curved arrows in broken lines pointing in the direction towards which the water is moving and the mean velocity is given in miles per hour. (e. g. 2 miles).

NOVEMBER.





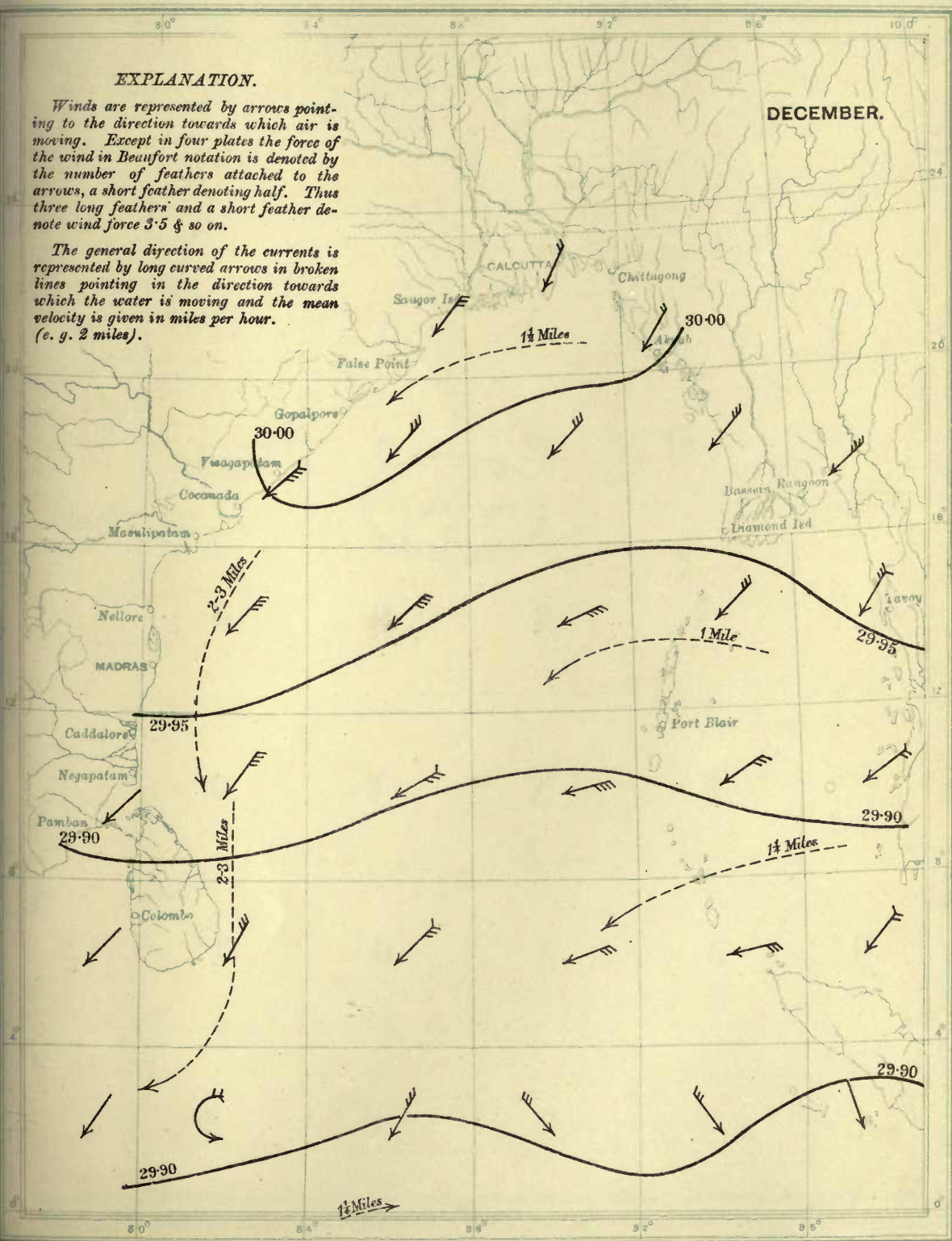
MEAN 8 A. M. BAROMETRIC HEIGHT REDUCED TO SEA-LEVEL AND CONSTANT GRAVITY AT
LAT. 45°, MEAN DAILY WIND DIRECTION AND MEAN CURRENT DIRECTIONS
FOR MONTH OF DECEMBER IN BAY OF BENGAL

EXPLANATION.

Winds are represented by arrows pointing to the direction towards which air is moving. Except in four plates the force of the wind in Beaufort notation is denoted by the number of feathers attached to the arrows, a short feather denoting half. Thus three long feathers and a short feather denote wind force 3·5 & so on.

The general direction of the currents is represented by long curved arrows in broken lines pointing in the direction towards which the water is moving and the mean velocity is given in miles per hour. (e. g. 2 miles).

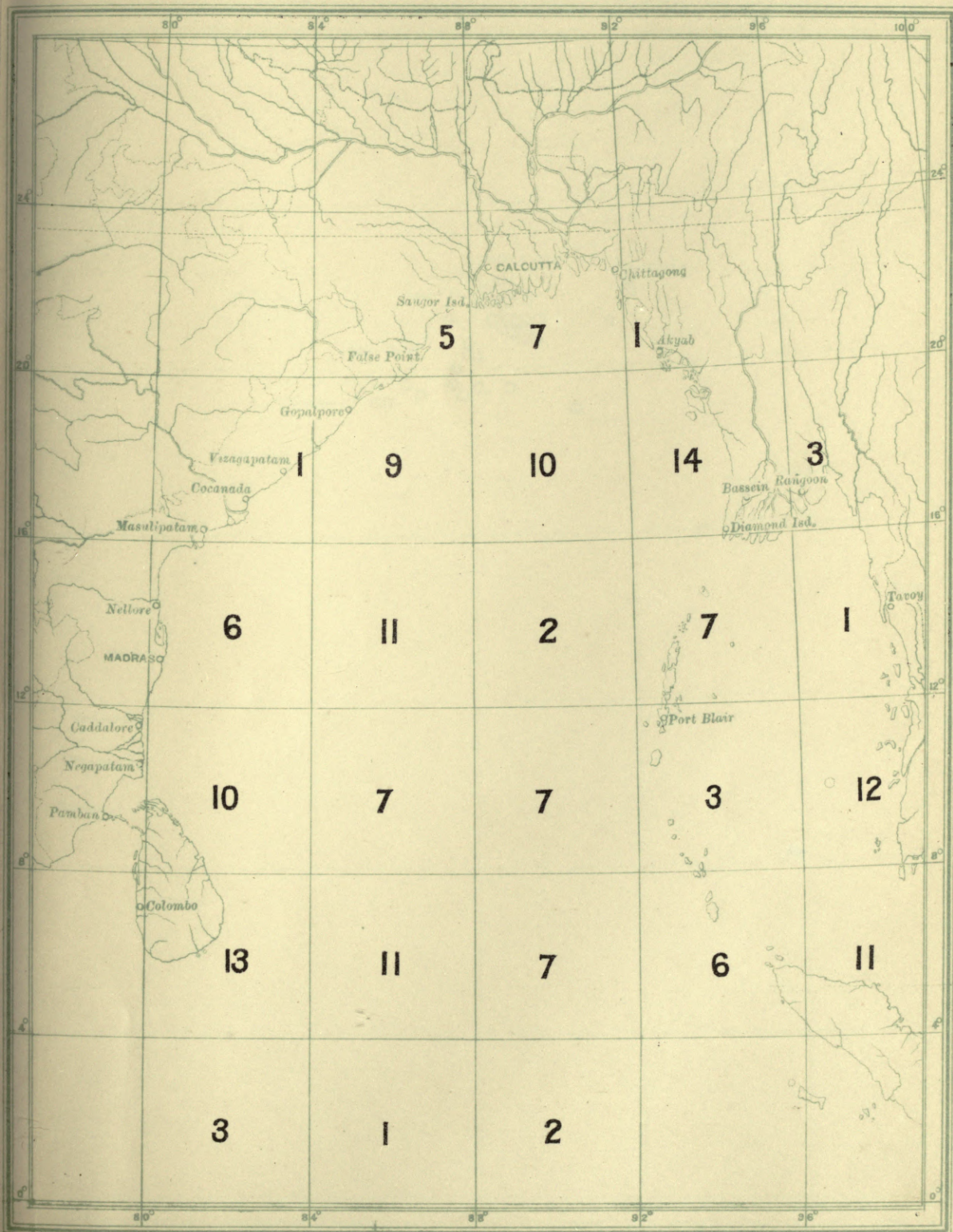
DECEMBER.



AND A HYDROGRAPHIC SURVEY OF THE GULF OF MEXICO AND THE CARIBBEAN SEA
BY THE U. S. NAVY OFFICE AND THE U. S. GEOLOGICAL SURVEY
FOR MONTHS OF 1854 AND 1855



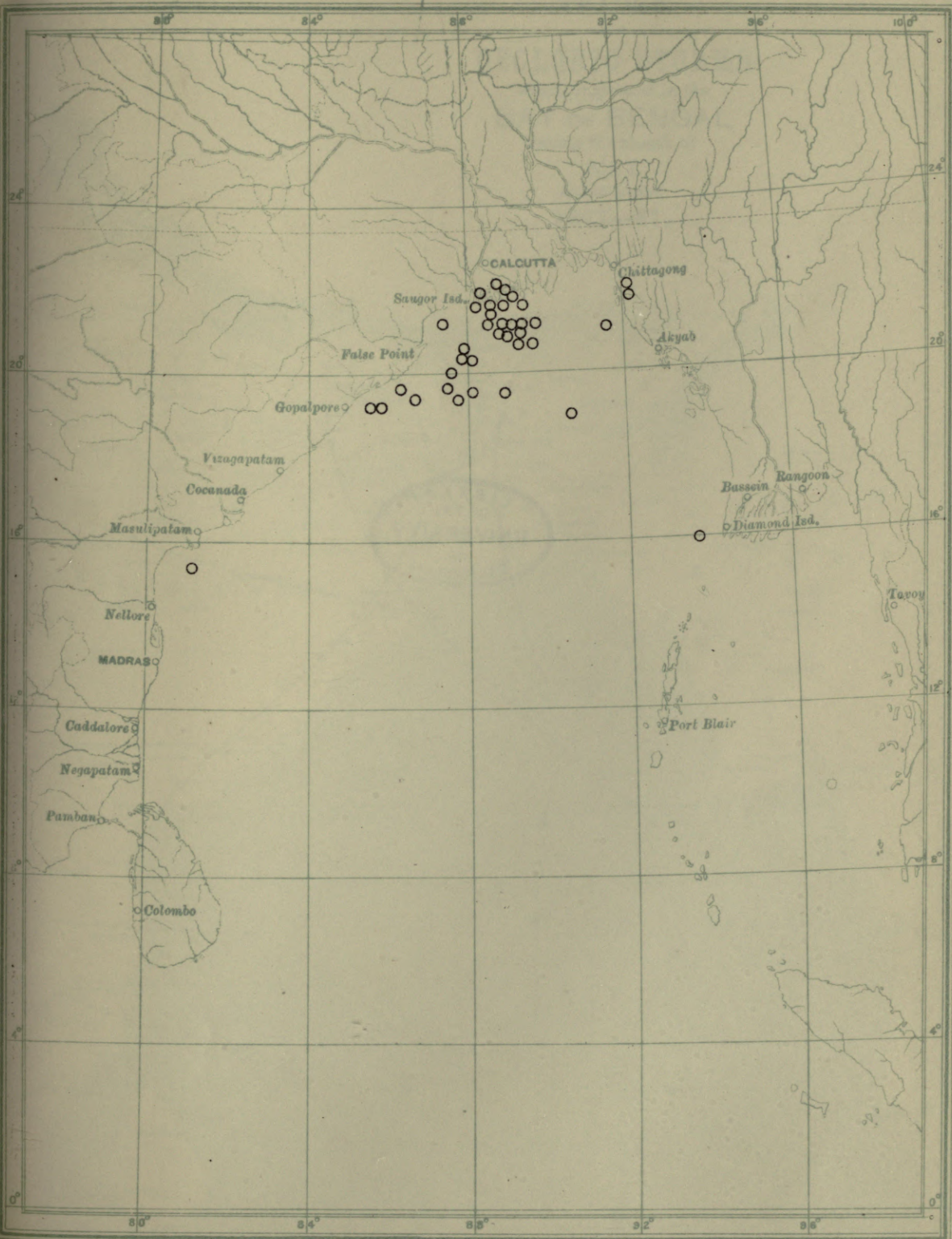
CHART GIVING NUMBER OF SQUALLS REPORTED IN EACH SECTION OF THE BAY
DURING THE PERIOD 1893 TO 1898.



Great Lakes and St. Lawrence River. The map is divided into four sections by the St. Lawrence River and the Great Lakes. The sections are labeled as follows: 1. The Great Lakes, 2. The St. Lawrence River, 3. The Gulf of St. Lawrence, and 4. The Atlantic Ocean.

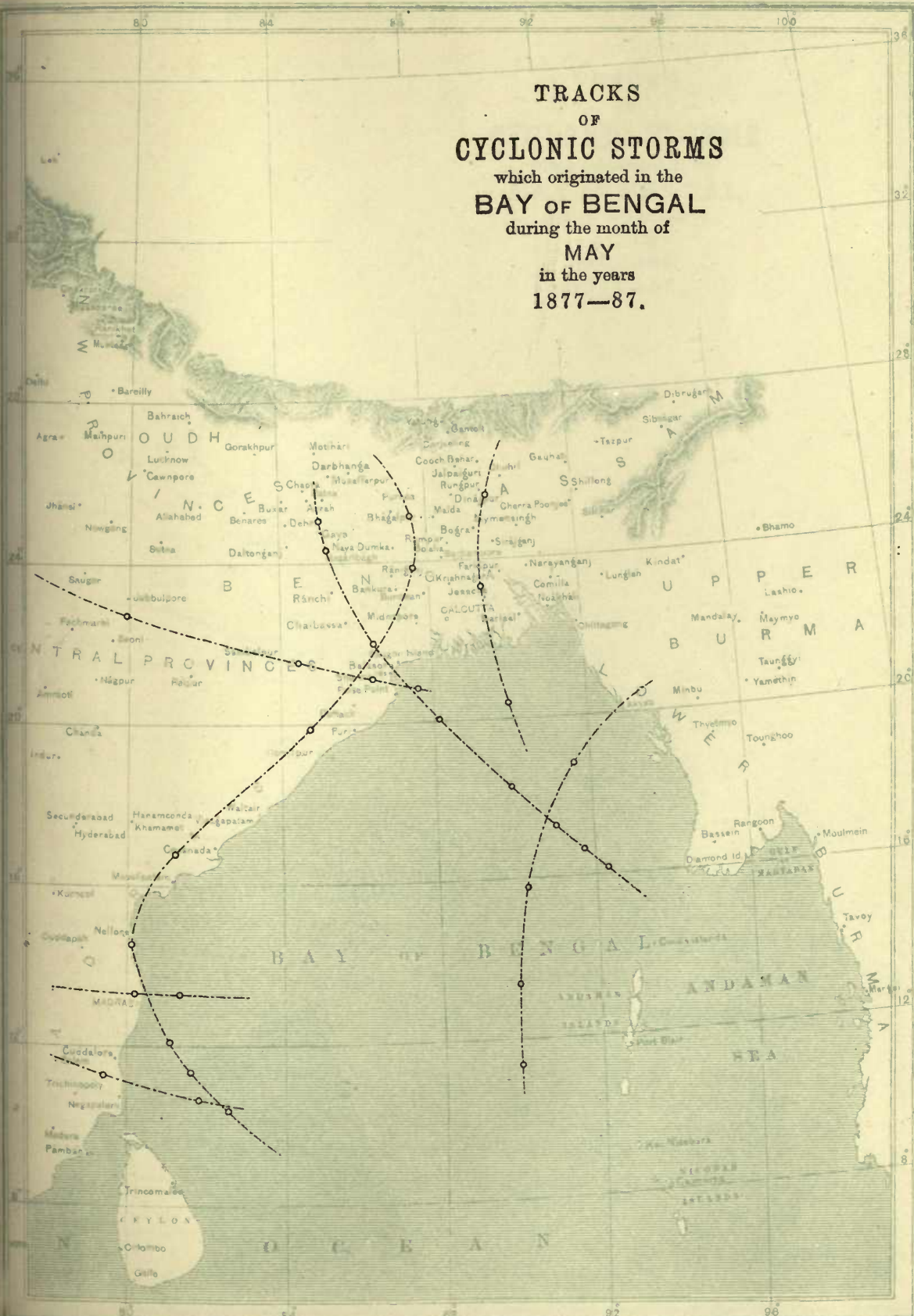


CHART SHOWING SPACE DISTRIBUTION OF NORWESTERS IN THE BAY
DURING THE PERIOD 1883 TO 1898.





TRACKS
OF
CYCLONIC STORMS
which originated in the
BAY OF BENGAL
during the month of
MAY
in the years
1877—87.



1885-1886

of the ... of the ...

LIBRARY
OF THE
UNIVERSITY
OF CALIFORNIA
MAY
1885



TRACKS
OF
CYCLONIC STORMS
which originated in the
BAY OF BENGAL
during the month of
JUNE
in the years
1877—87.

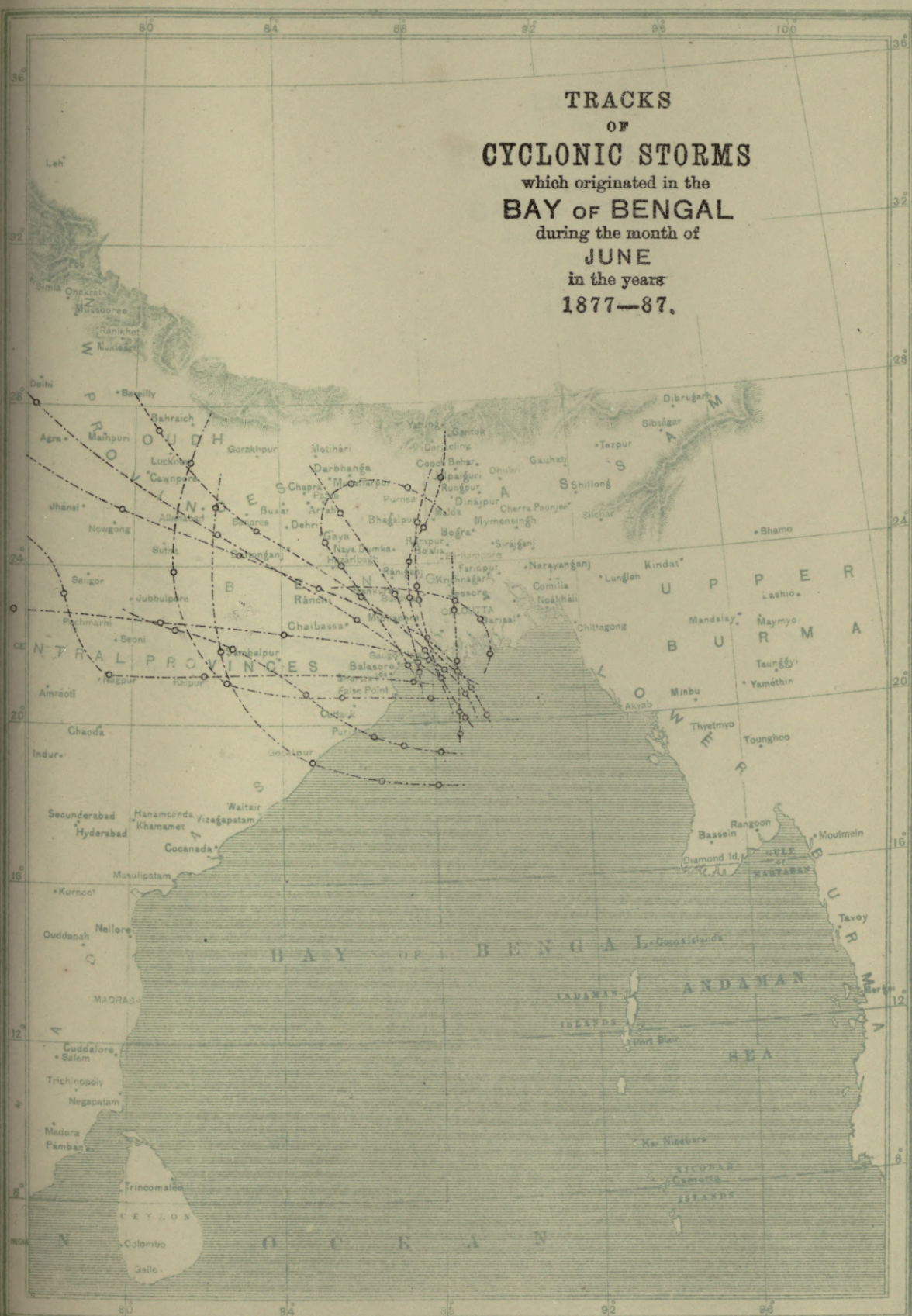
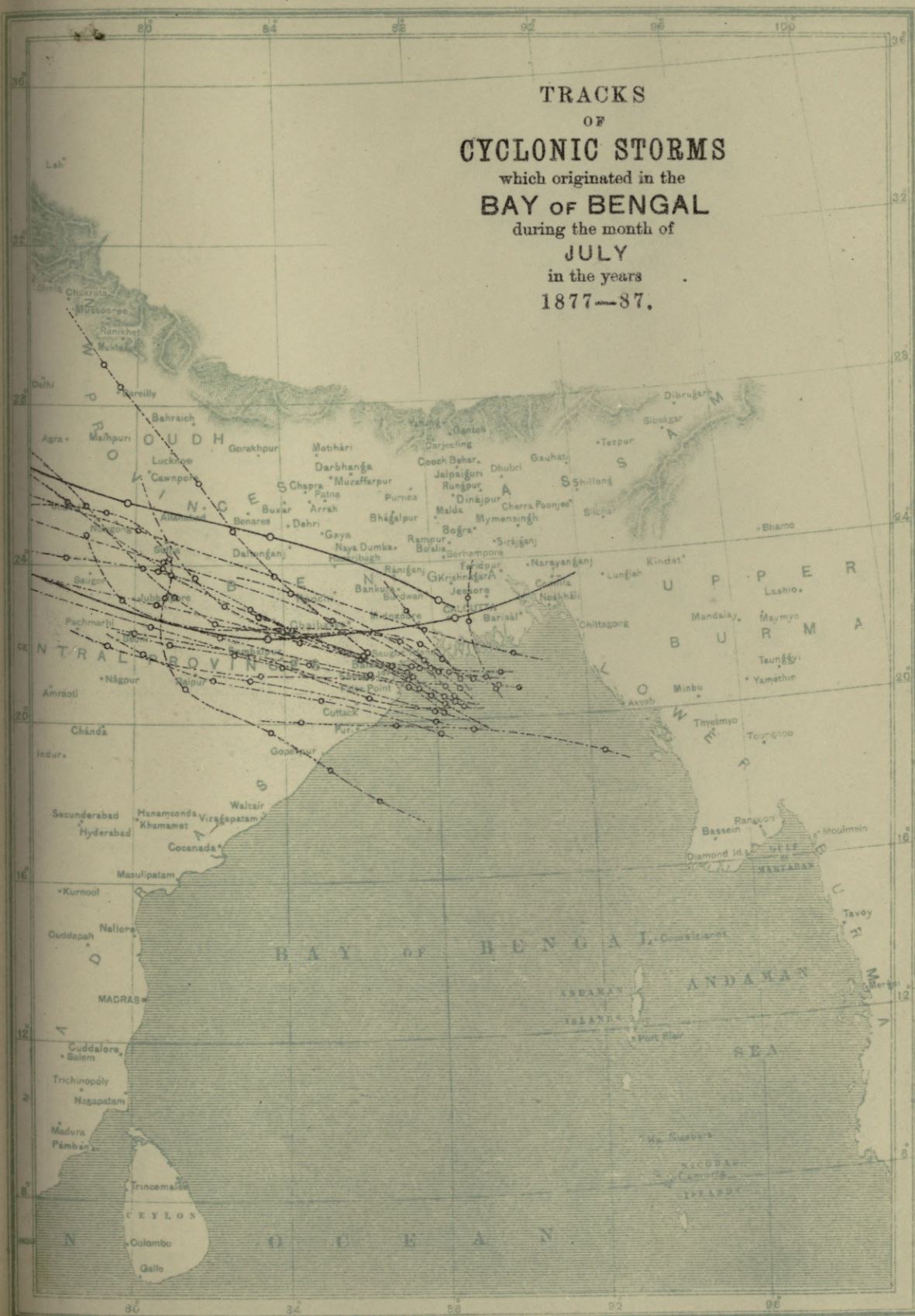


TABLE
OF
GEOLOGICAL STATIONS
IN THE
BAY OF BENGAL
AND
ADJACENT
REGIONS



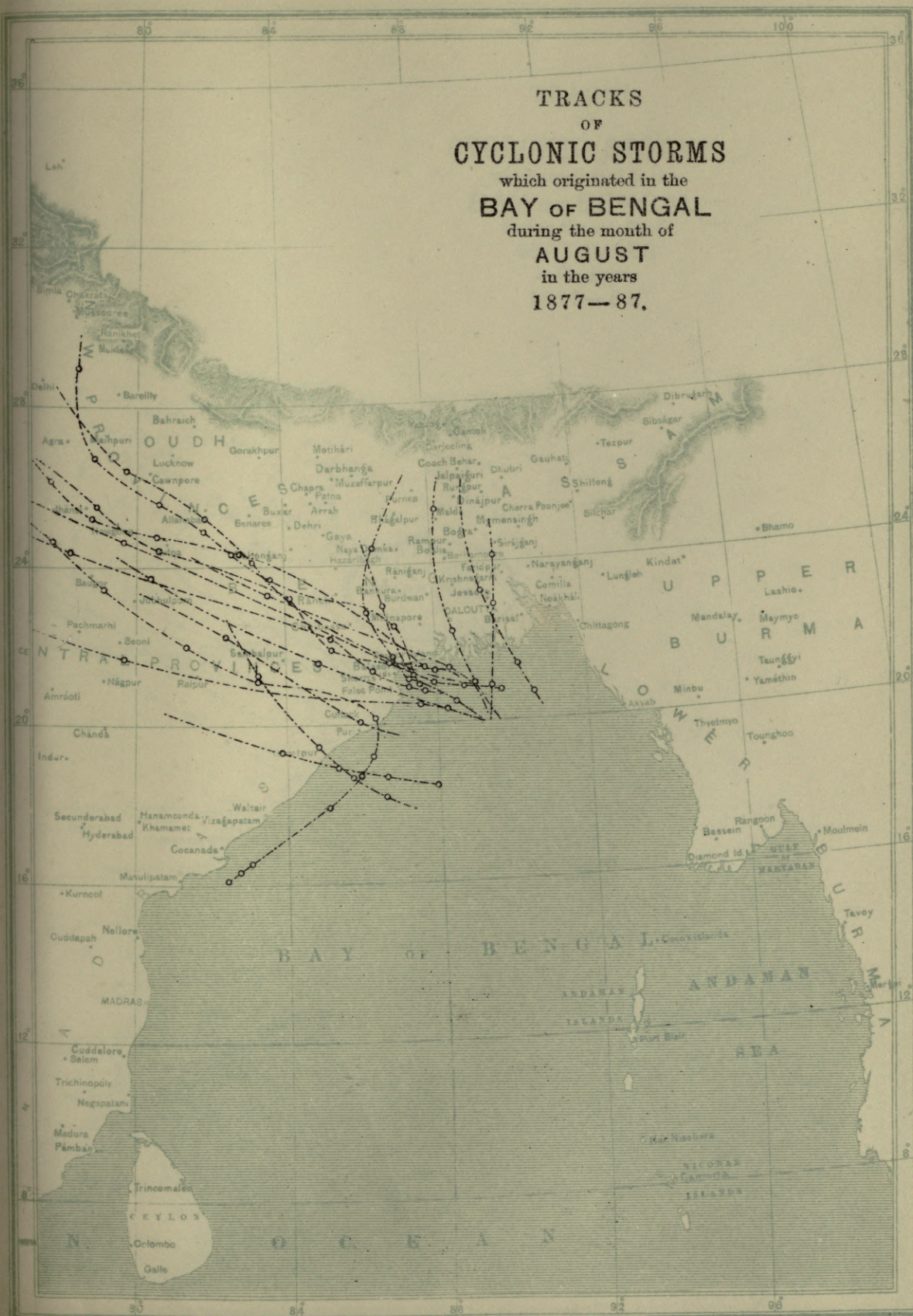
TRACKS OF CYCLONIC STORMS

which originated in the
BAY OF BENGAL
during the month of
JULY
in the years
1877-87.



TRACKS OF CYCLONIC STORMS

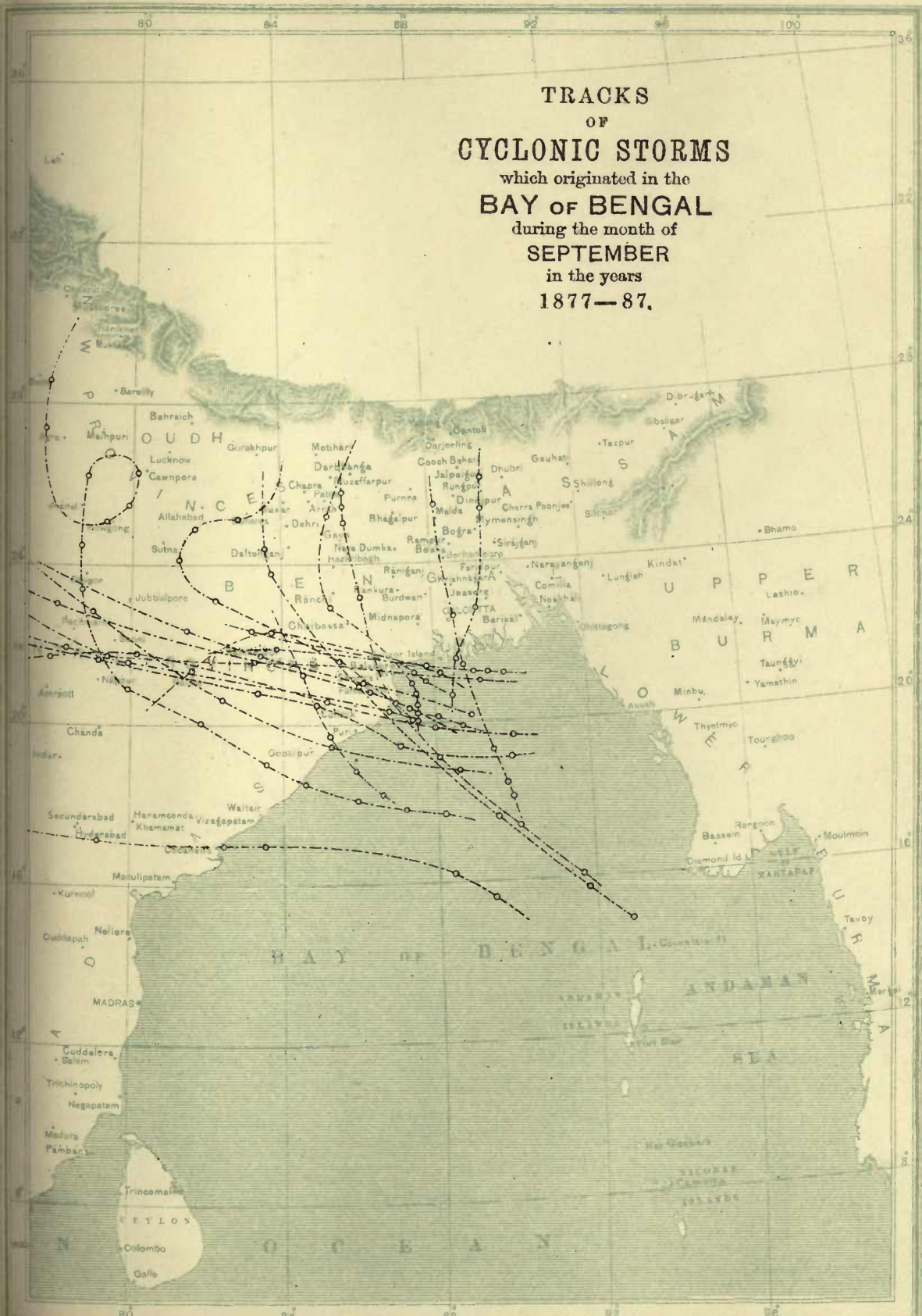
which originated in the
BAY OF BENGAL
during the month of
AUGUST
in the years
1877—87.



FRAGILE
OF
CYCLOPS STORM
BAY OF BENGAL
AUGUST
1877

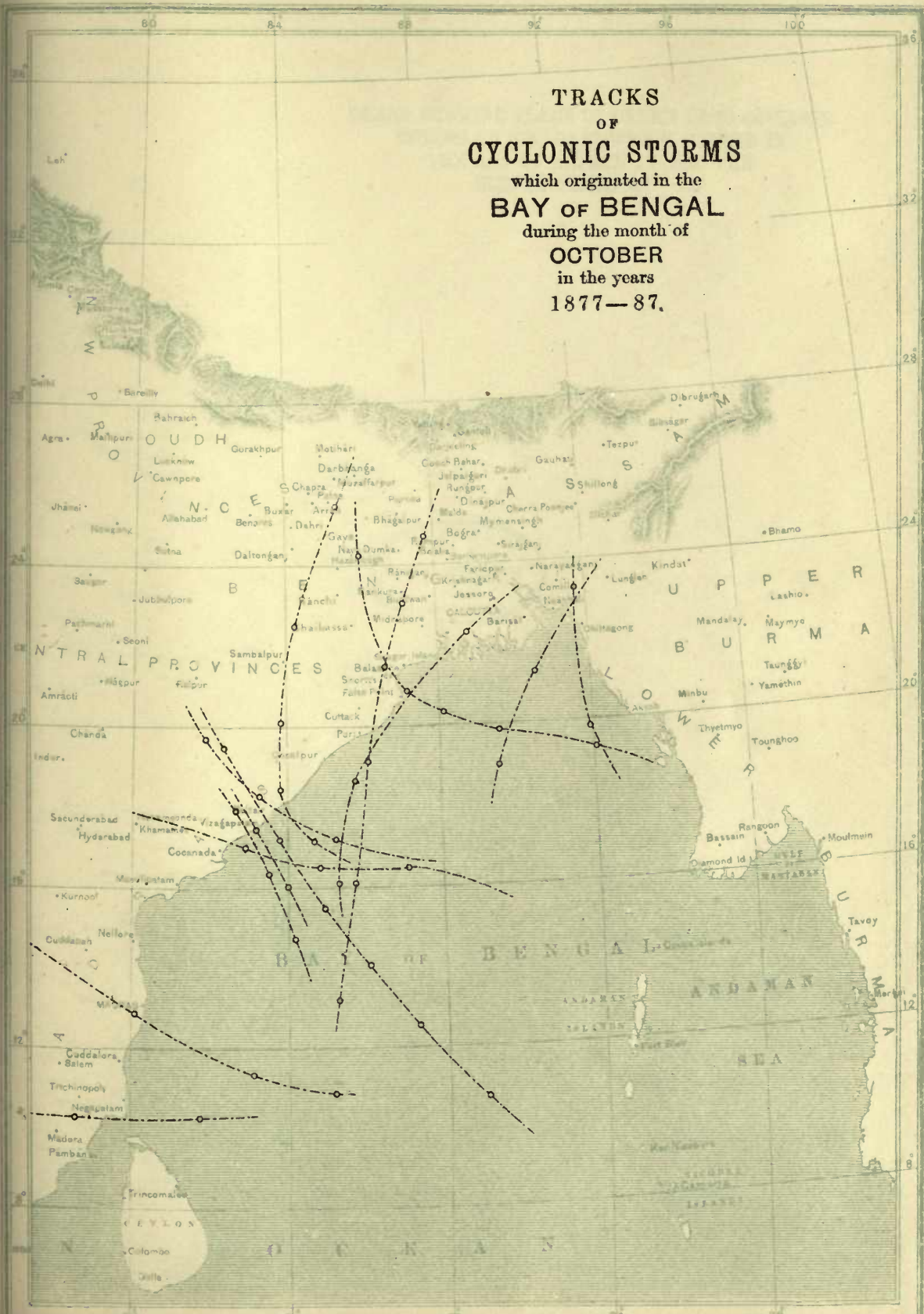


TRACKS
OF
CYCLONIC STORMS
which originated in the
BAY OF BENGAL
during the month of
SEPTEMBER
in the years
1877—87.





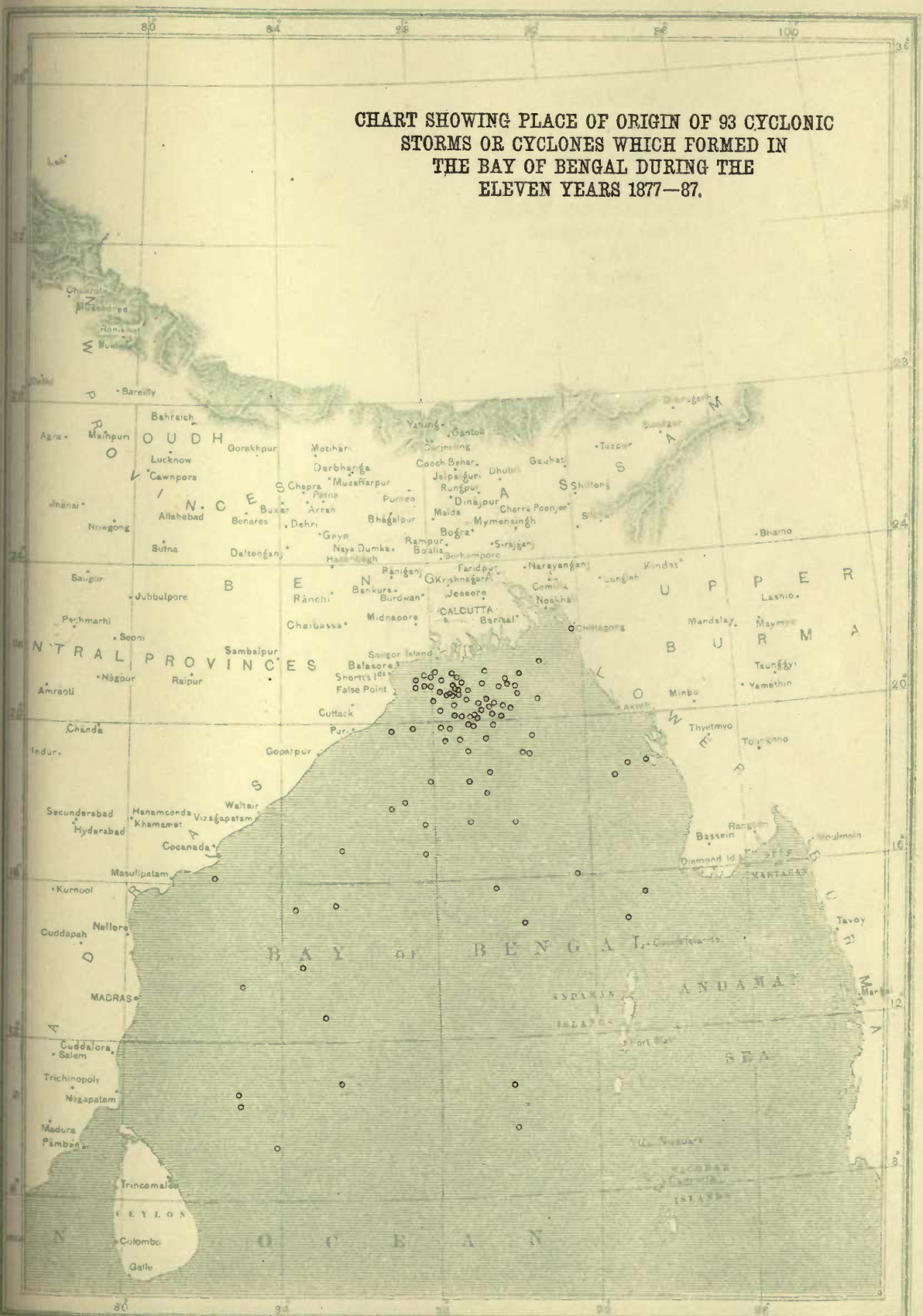
TRACKS
OF
CYCLONIC STORMS
which originated in the
BAY OF BENGAL
during the month of
OCTOBER
in the years
1877—87.



THANKS
TO
STUDENTS
OF THE
UNIVERSITY OF CALIFORNIA
FOR THE
PRESENTATION
OF THIS
VOLUME



CHART SHOWING PLACE OF ORIGIN OF 93 CYCLONIC
STORMS OR CYCLONES WHICH FORMED IN
THE BAY OF BENGAL DURING THE
ELEVEN YEARS 1877—87.

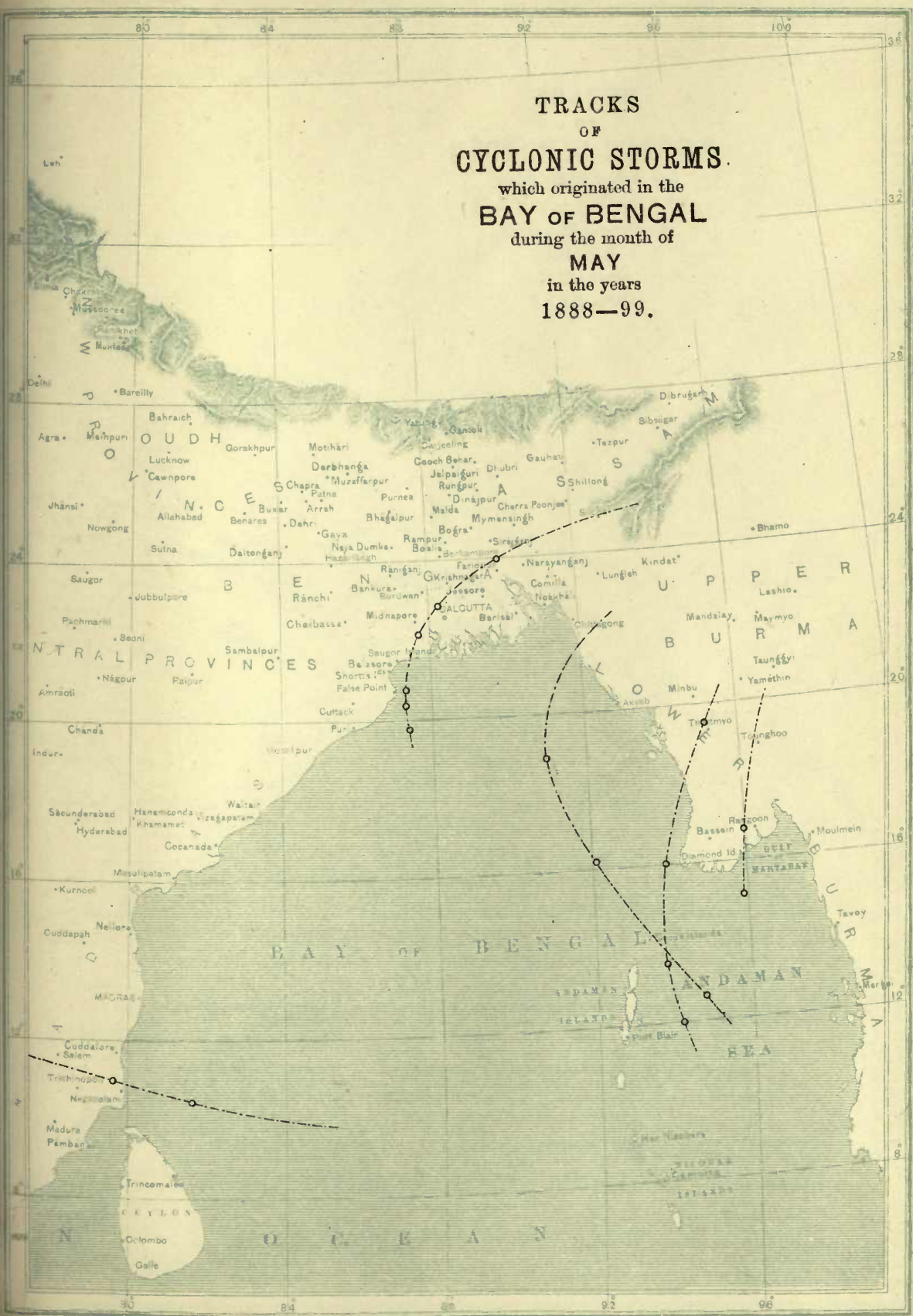


THE UNIVERSITY OF CHICAGO LIBRARY
1850-1855
THE UNIVERSITY OF CHICAGO LIBRARY
1850-1855



TRACKS OF CYCLONIC STORMS.

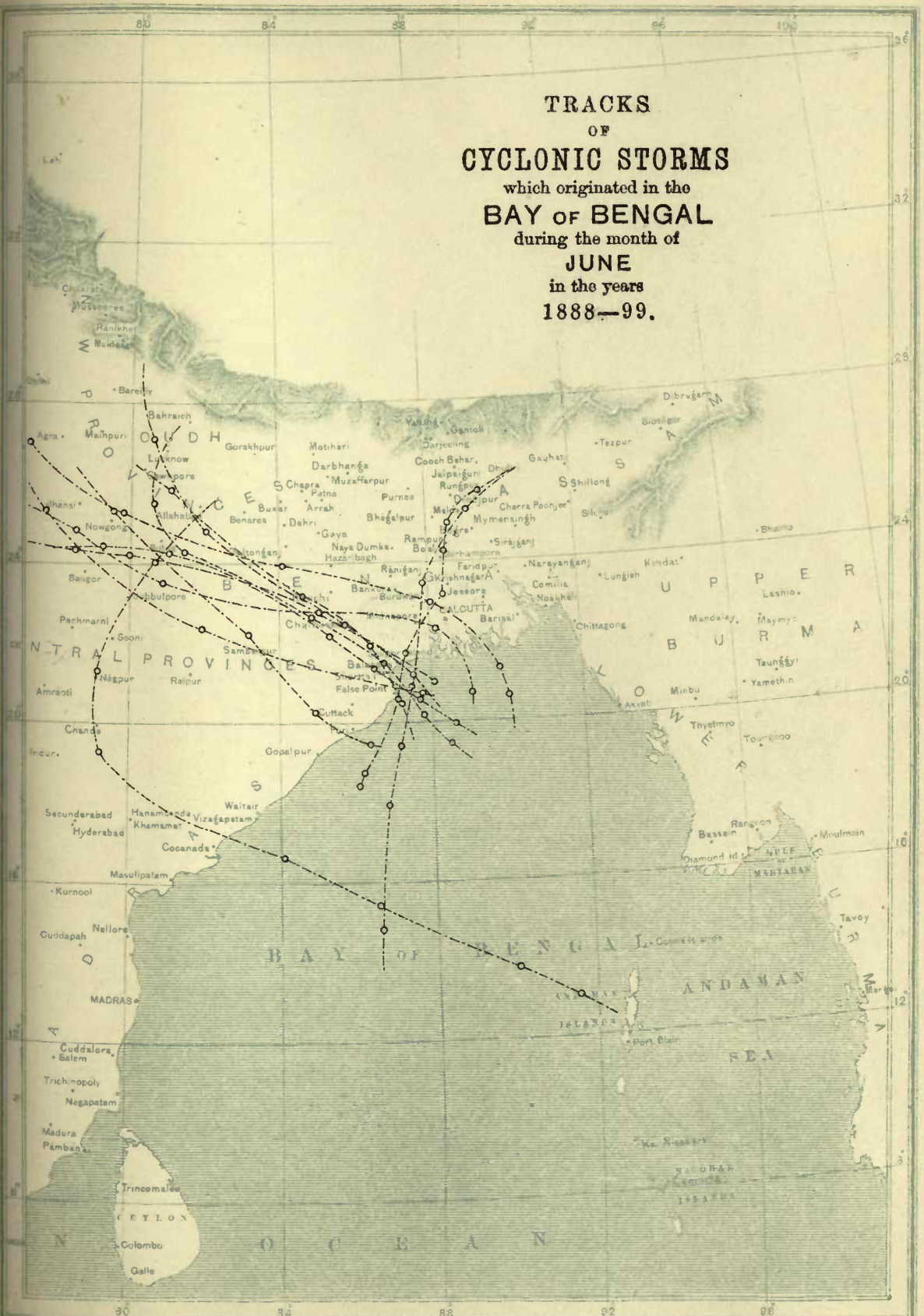
which originated in the
BAY OF BENGAL
during the month of
MAY
in the years
1888—99.



THE
OF
STANDARD BOOKS
JAMES H. YAG
MAY
1900



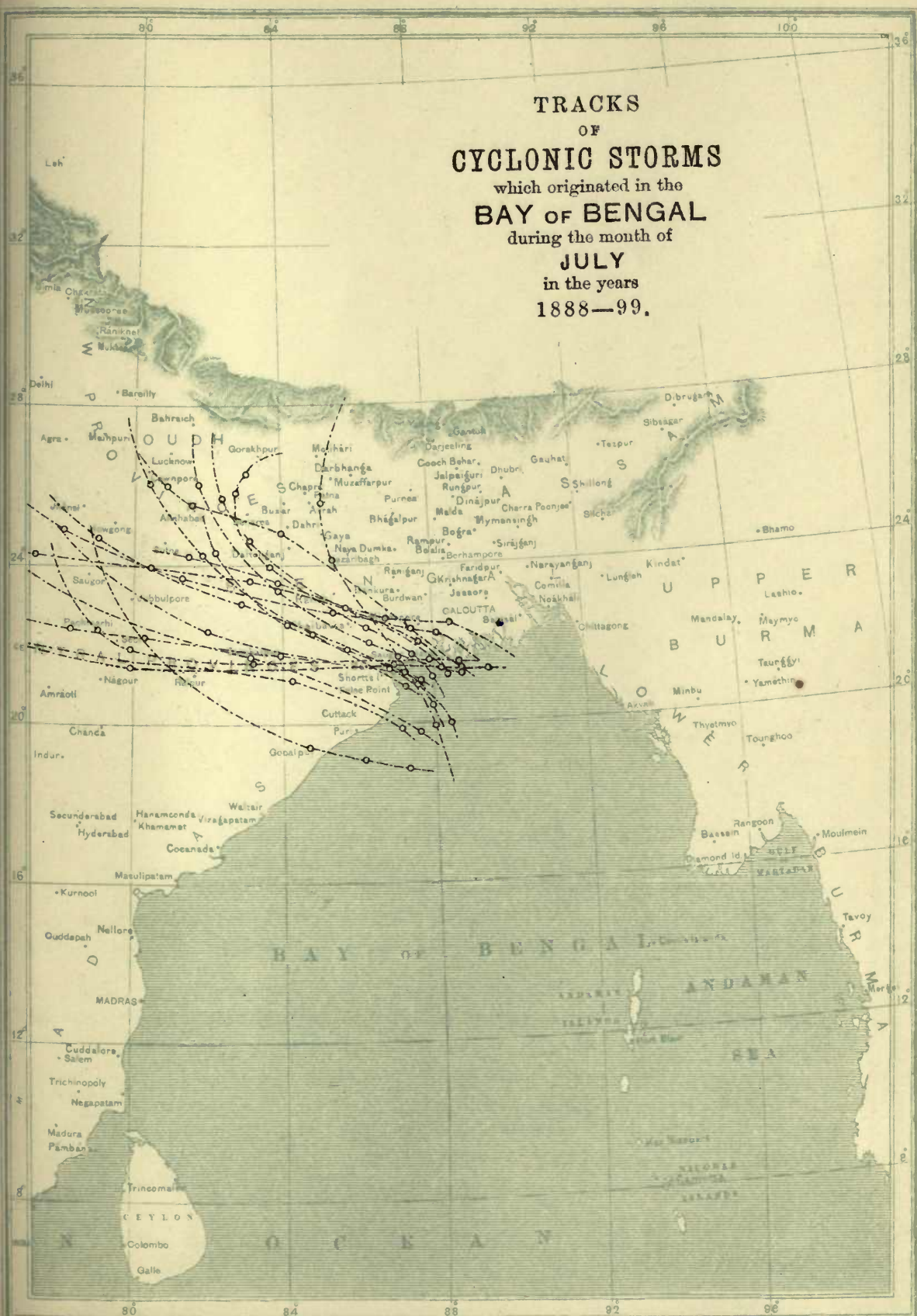
TRACKS
OF
CYCLONIC STORMS
which originated in the
BAY OF BENGAL
during the month of
JUNE
in the years
1888—99.



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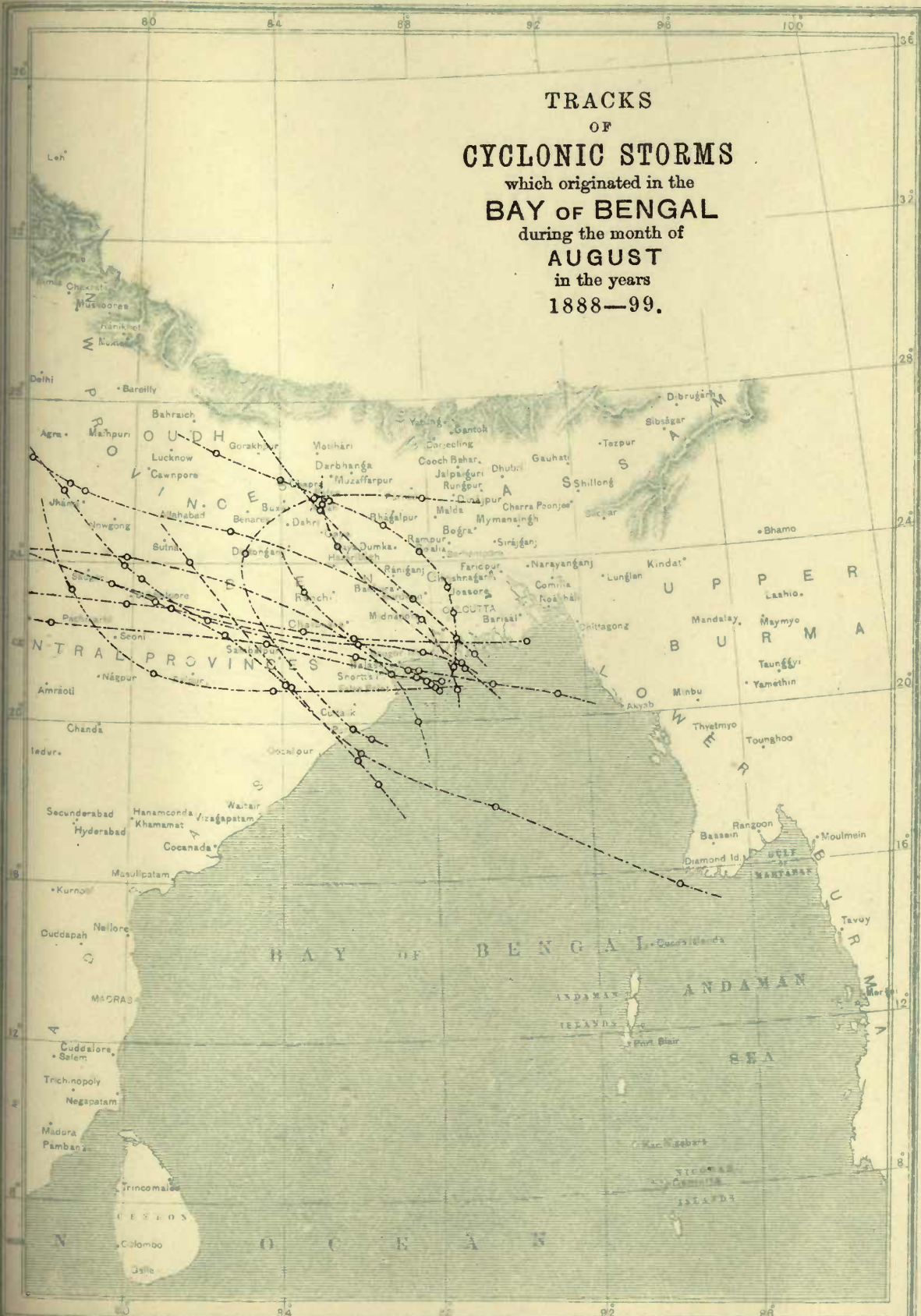


TRACKS
OF
CYCLONIC STORMS
which originated in the
BAY OF BENGAL
during the month of
JULY
in the years
1888—99.



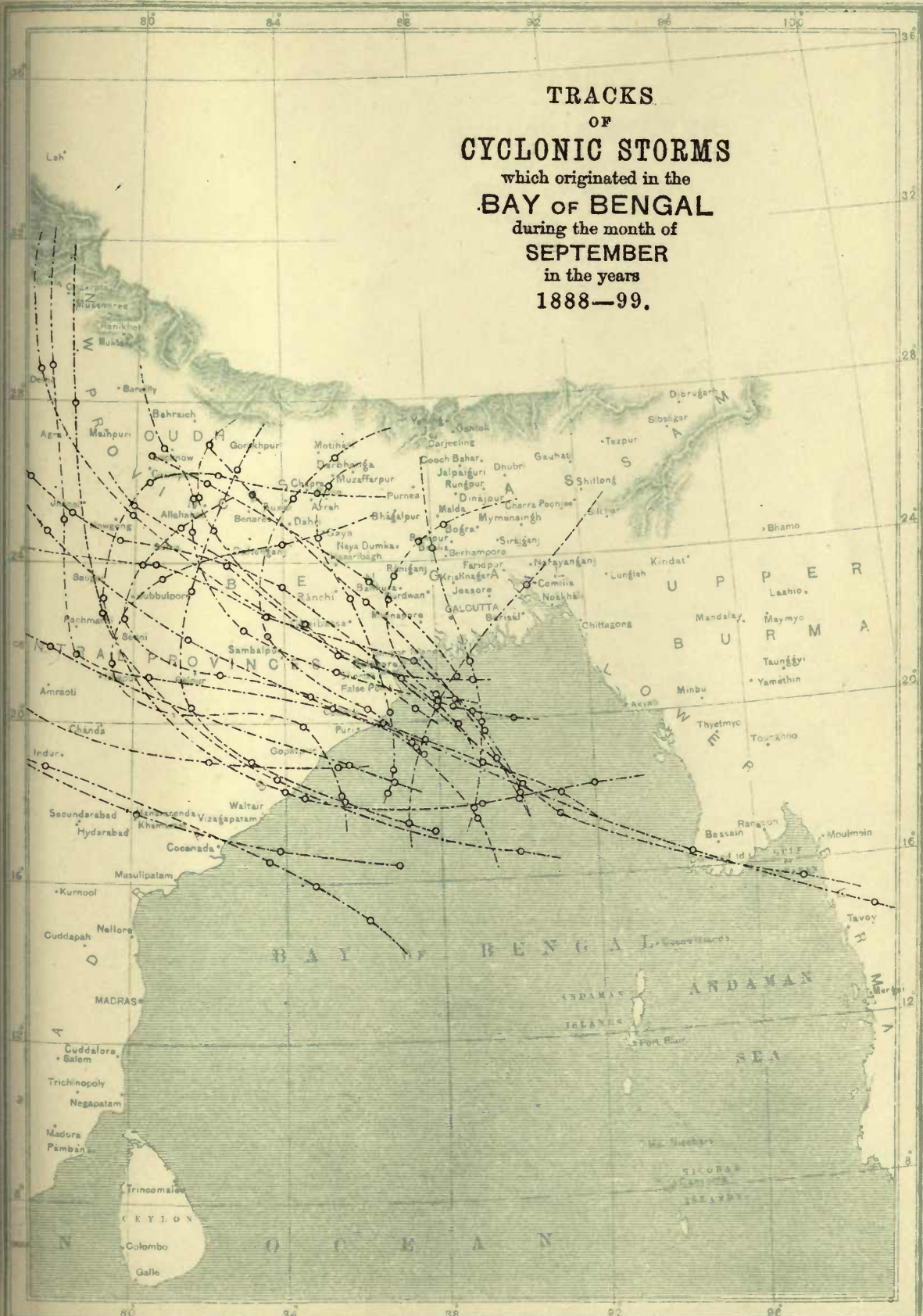


TRACKS
OF
CYCLONIC STORMS
which originated in the
BAY OF BENGAL
during the month of
AUGUST
in the years
1888—99.



STORMS
OF
CYCLONIC STORMS
which originate in the
BAY OF BENGAL
during the month of
AUGUST
in the years
1875-1888

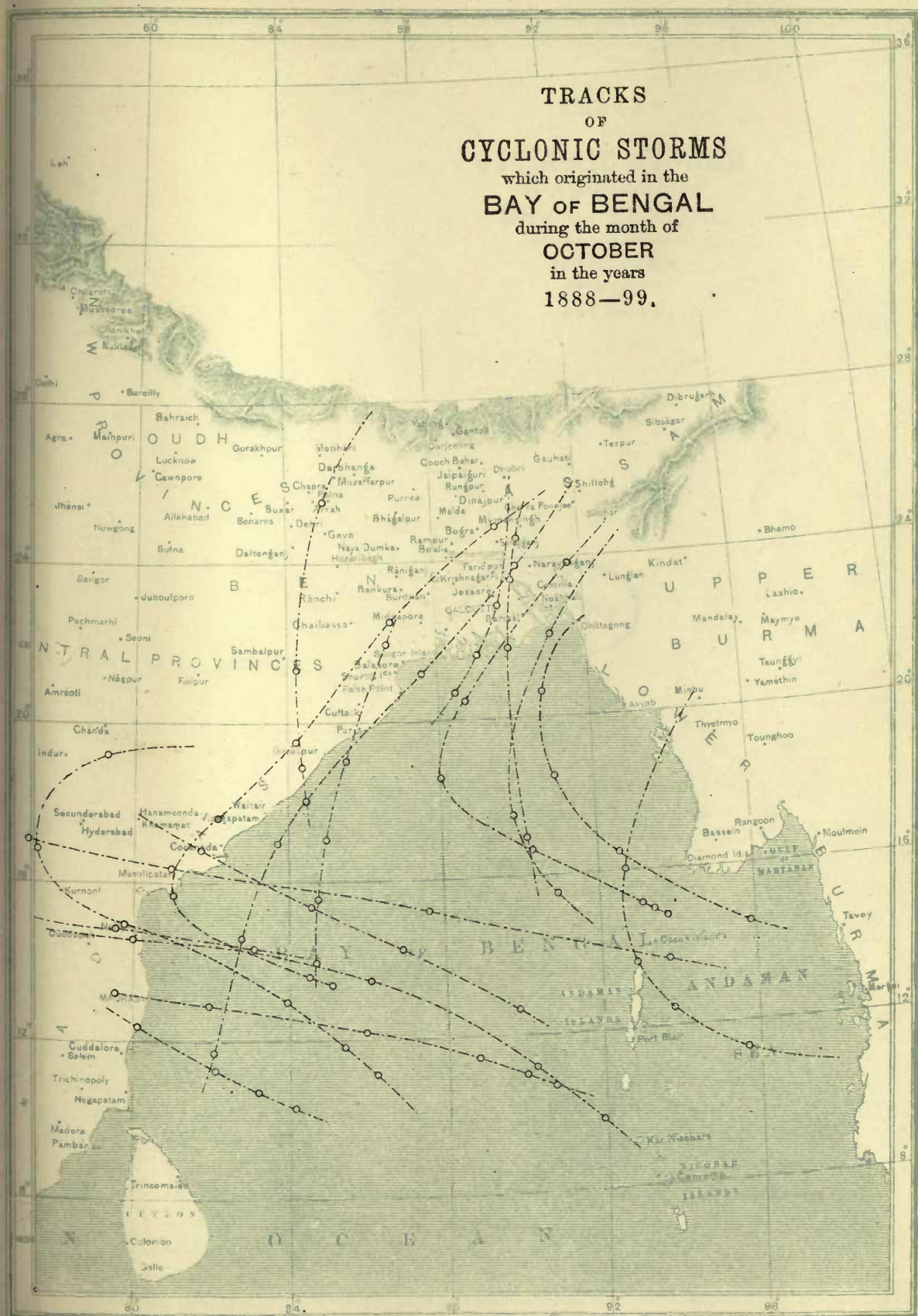




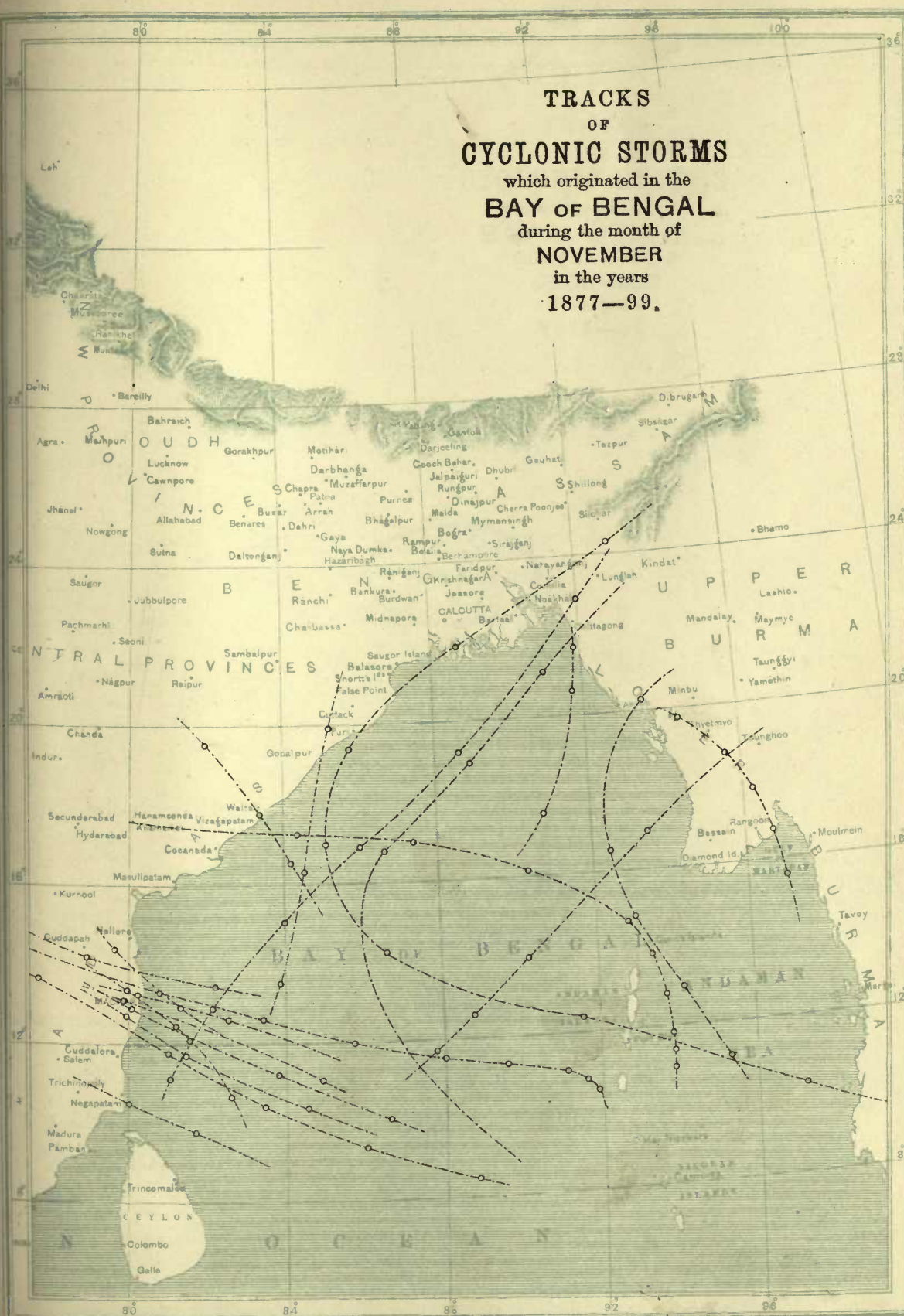
TRACKS
OF
CYCLONIC STORMS
which originated in the
BAY OF BENGAL
during the month of
SEPTEMBER
in the years
1888-99.

THE
CYCLONE STORMS
OF THE
BAY OF BENGAL
AND
ARABIAN SEA
BY
J. H. COLEMAN
1882-83





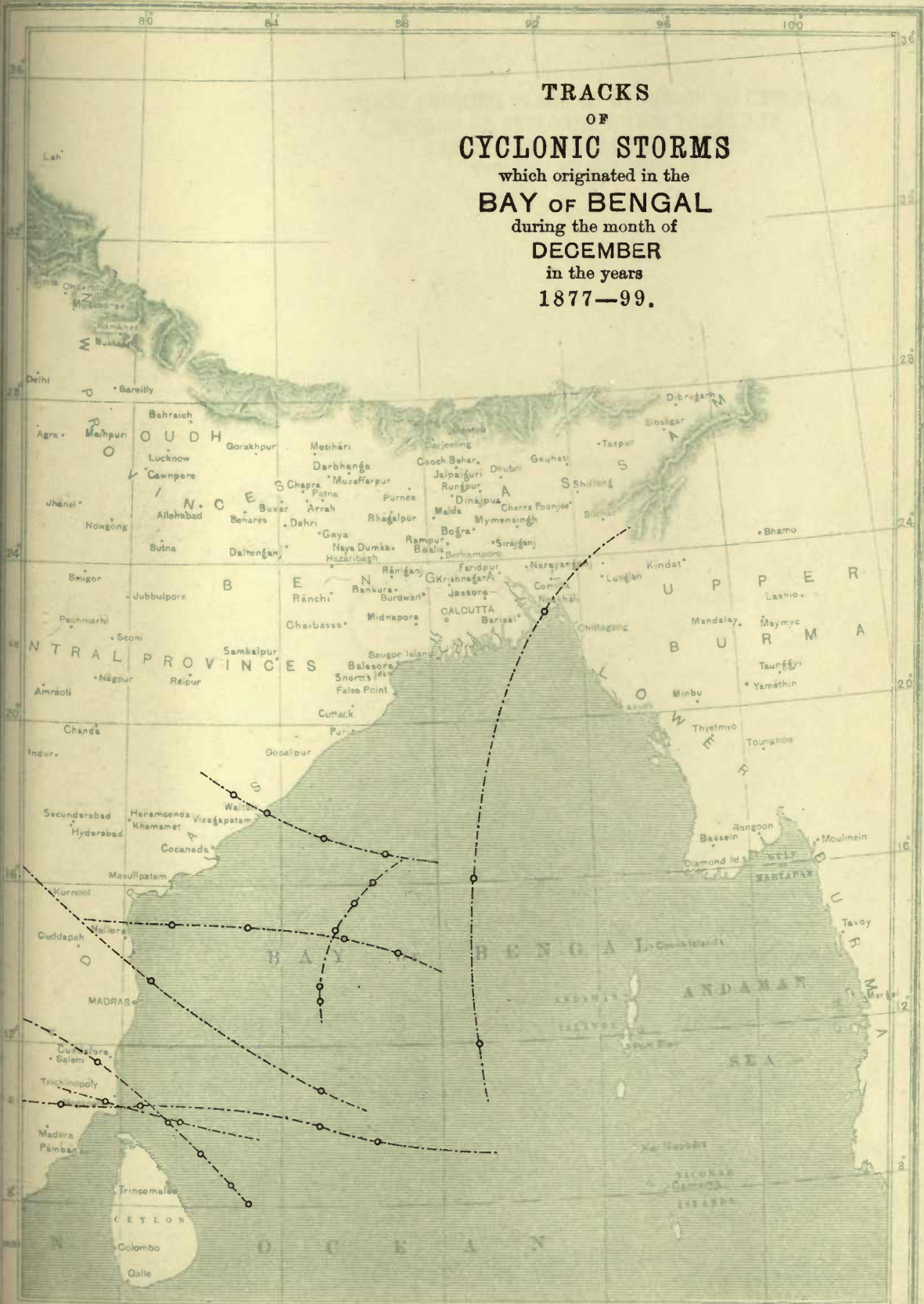




TRACKS
OF
CYCLONIC STORMS
which originated in the
BAY OF BENGAL
during the month of
NOVEMBER
in the years
1877-99.



TRACKS
OF
CYCLONIC STORMS
which originated in the
BAY OF BENGAL
during the month of
DECEMBER
in the years
1877—99.



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CHART SHOWING PLACE OF ORIGIN OF 119 CYCLONIC
STORMS OR CYCLONES WHICH FORMED IN
THE BAY OF BENGAL DURING THE
TWELVE YEARS 1888—99.

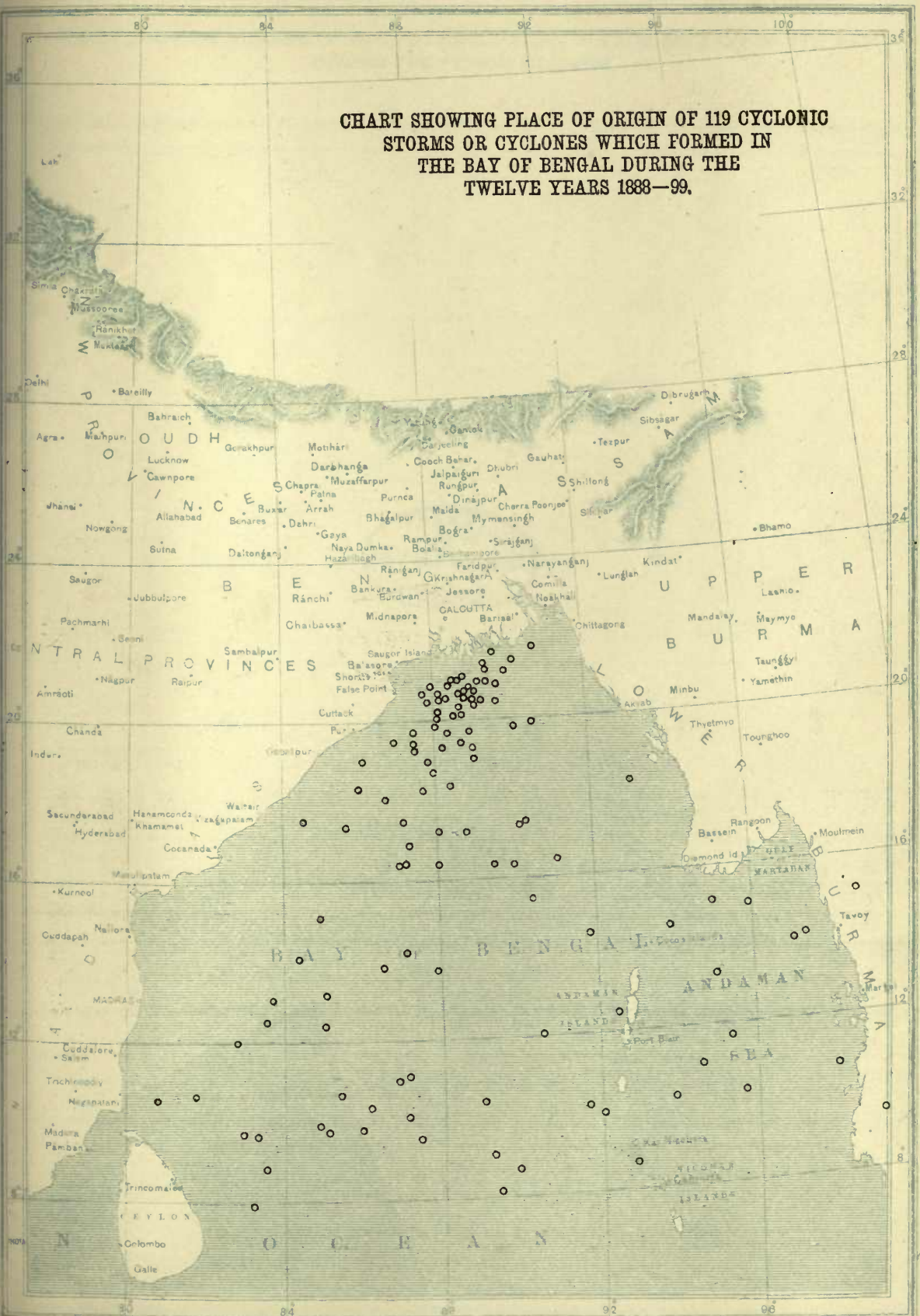
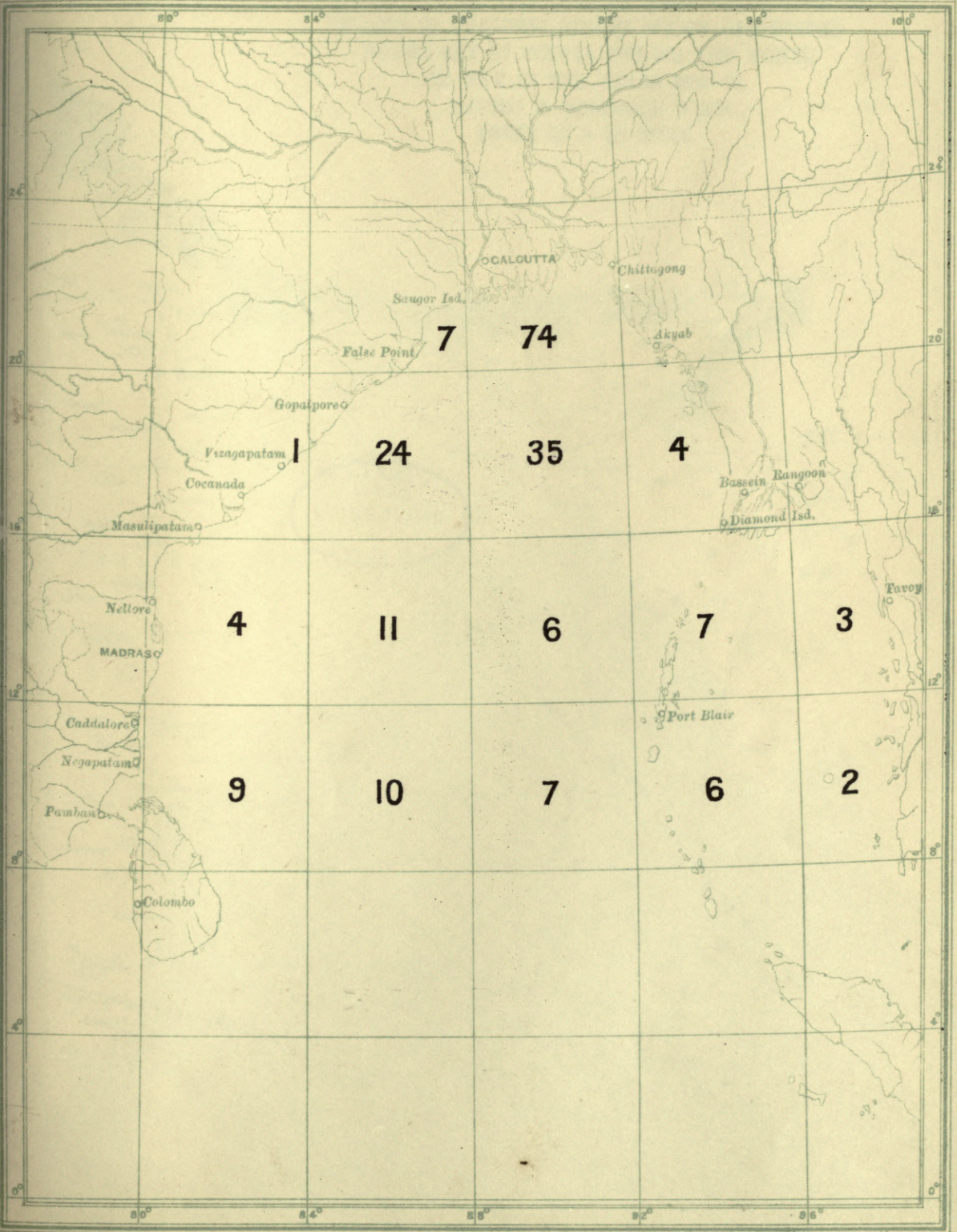




CHART SHOWING NUMBER OF STORMS ORIGINATING IN EACH SECTION OF THE BAY
DURING THE PERIOD 1877—1899.



THESE STONES WERE FOUND IN THE SANDS OF THE BEACH AT THE POINT OF THE BAY



**TRACKS OF CYCLONIC STORMS WHICH ORIGINATED
IN THE BAY OF BENGAL DURING THE MONTH
OF MAY IN THE YEARS 1882-99,
HAVING A RECORDED WIND
FORCE OF 8 OR MORE.**

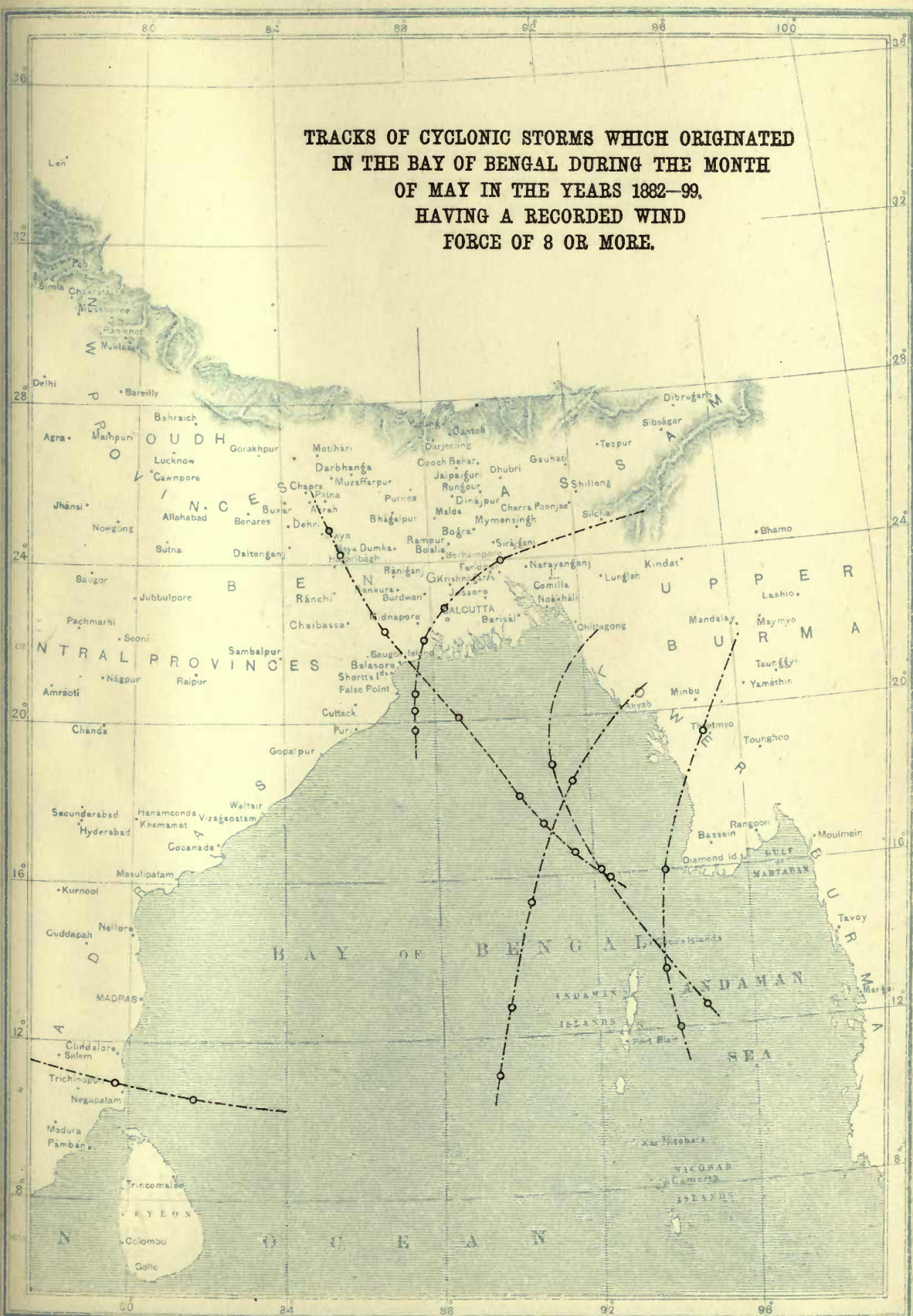
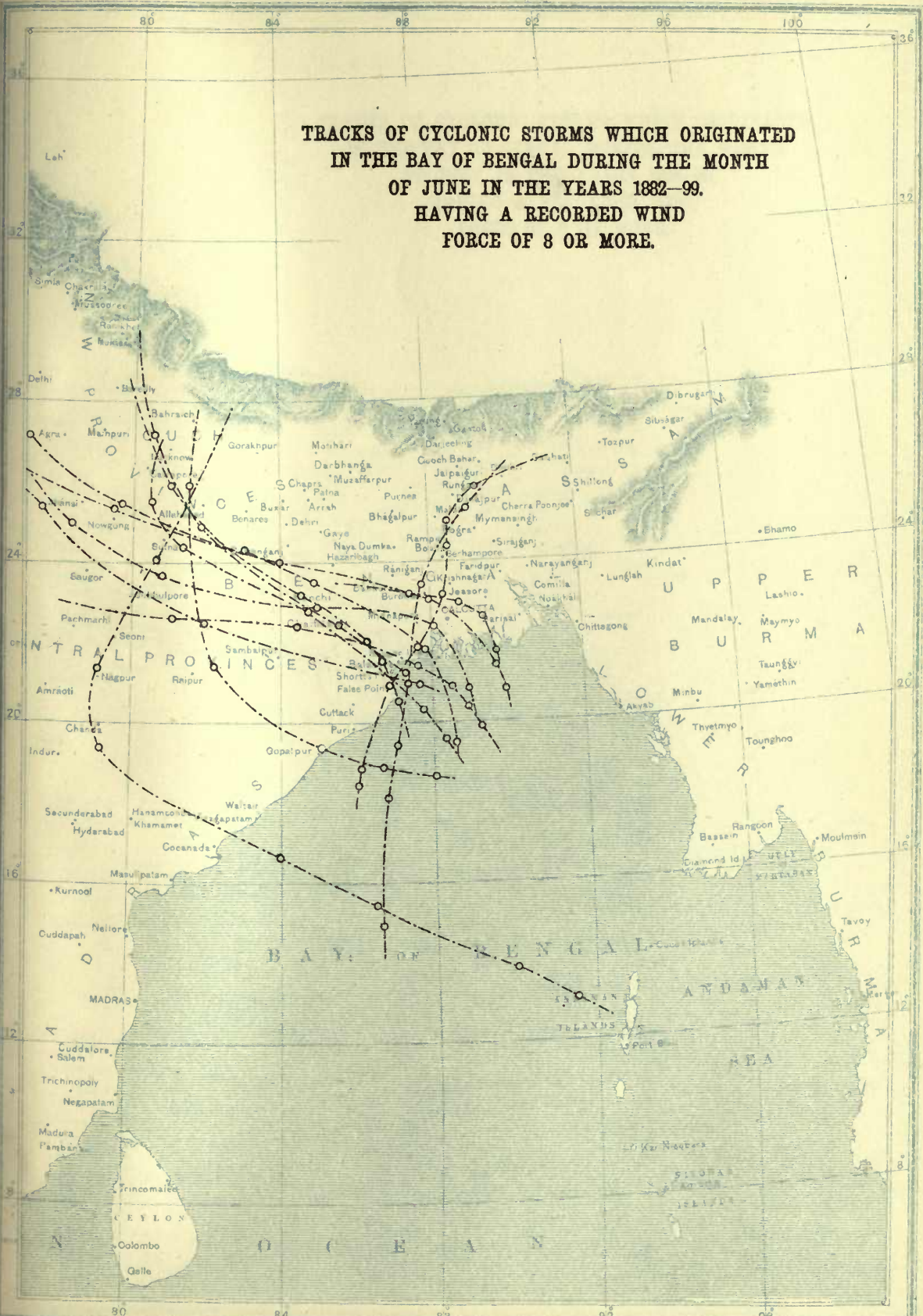


PLATE XXVIII
IN THE MOUNTAINS OF THE
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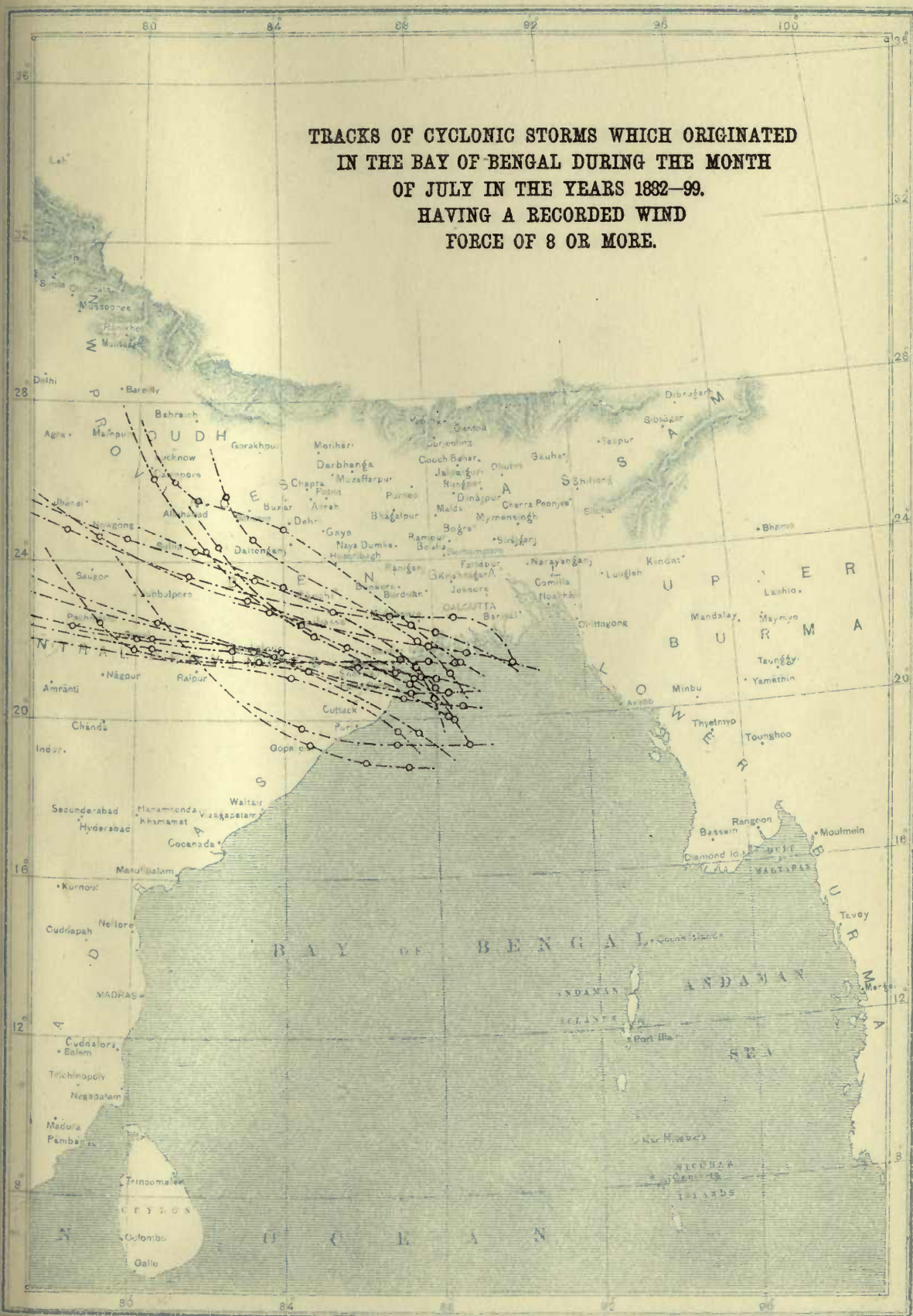
TRACKS OF CYCLONIC STORMS WHICH ORIGINATED
IN THE BAY OF BENGAL DURING THE MONTH
OF JUNE IN THE YEARS 1882-99.
HAVING A RECORDED WIND
FORCE OF 8 OR MORE.



ENTRANCE ADNEW CHURCH ORIGINALLY TO BEHOLD
FROM THE CHURCH LADDER TO THE CHURCH
IN THE DAY OF JUDGMENT THE CHURCH
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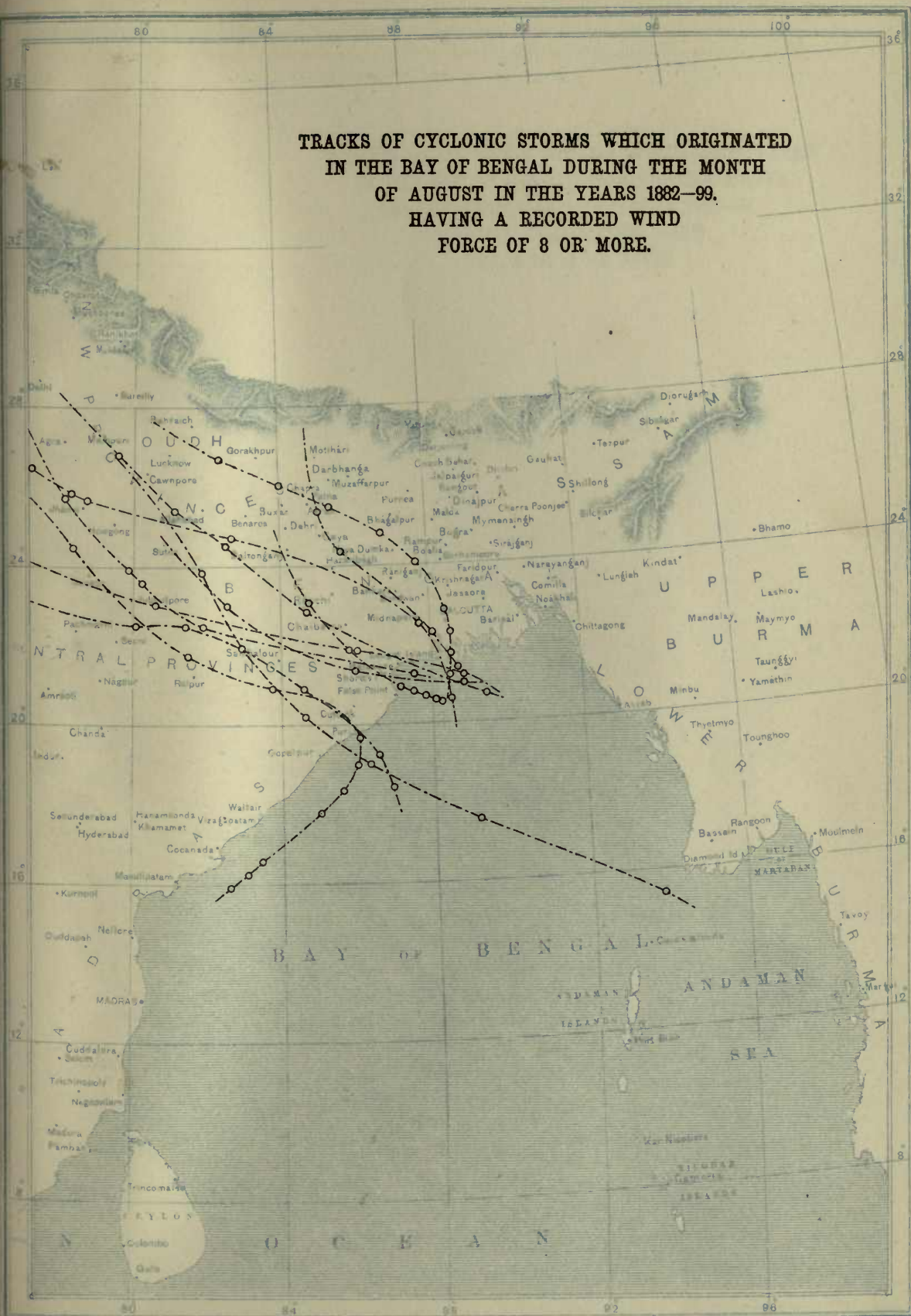


**TRACKS OF CYCLONIC STORMS WHICH ORIGINATED
IN THE BAY OF BENGAL DURING THE MONTH
OF JULY IN THE YEARS 1832-99.
HAVING A RECORDED WIND
FORCE OF 8 OR MORE.**





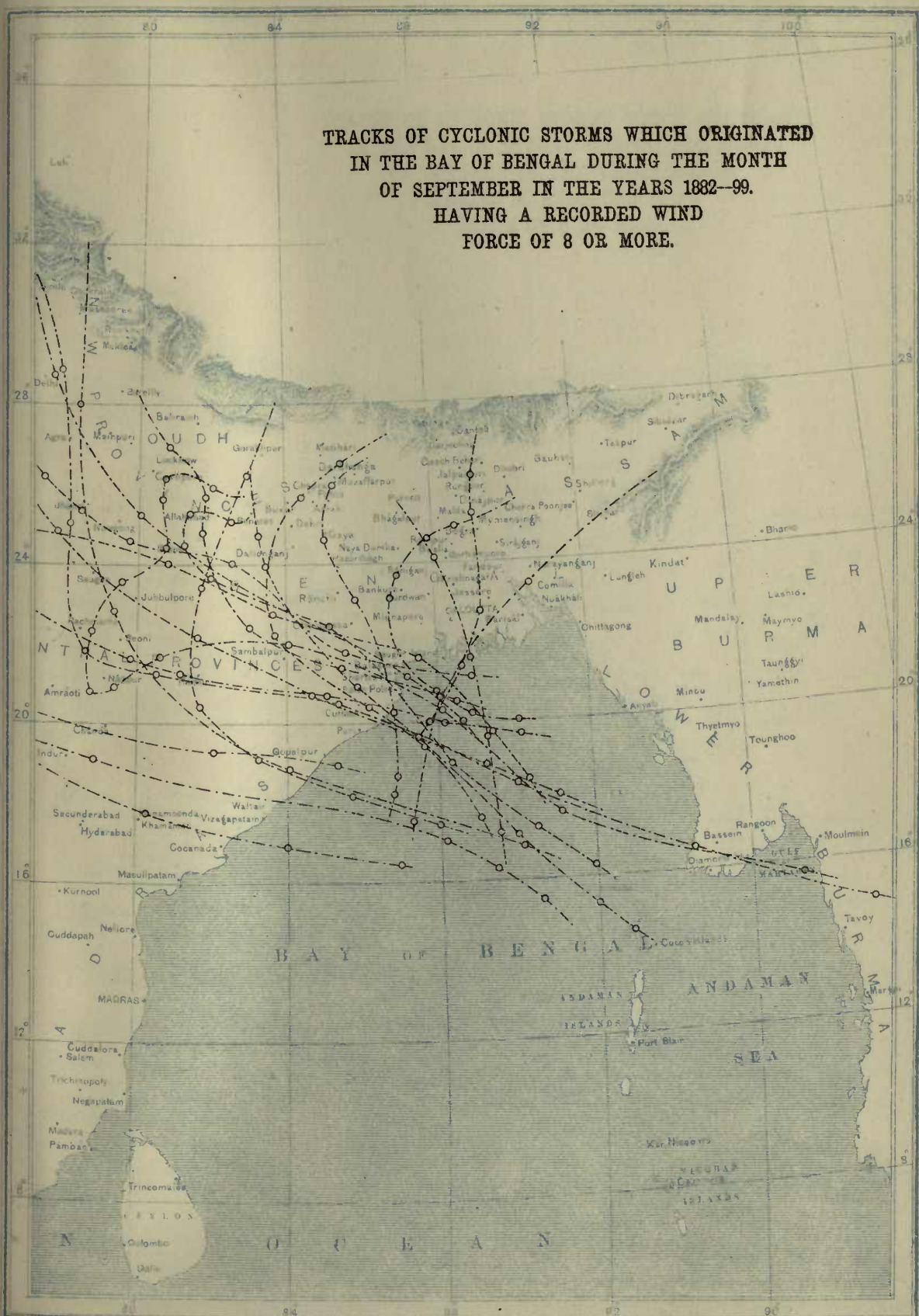
TRACKS OF CYCLONIC STORMS WHICH ORIGINATED
IN THE BAY OF BENGAL DURING THE MONTH
OF AUGUST IN THE YEARS 1882-99.
HAVING A RECORDED WIND
FORCE OF 8 OR MORE.



REMARKS OF COLLECTOR
IN THE BOT. GARDEN
OF ALASKA IN THE YEAR 1898
BY H. H. H. H. H.
JULY 1898



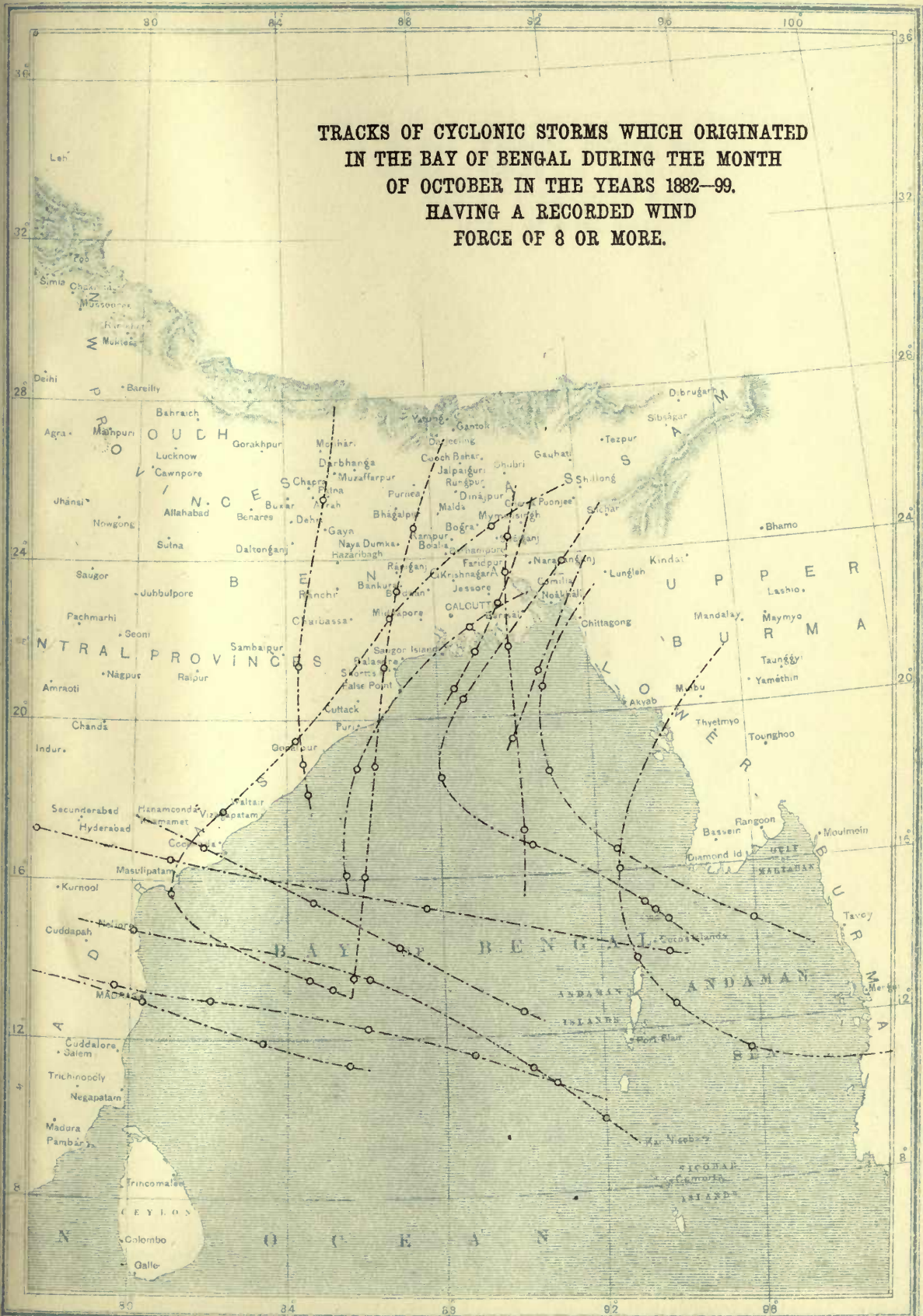
TRACKS OF CYCLONIC STORMS WHICH ORIGINATED
IN THE BAY OF BENGAL DURING THE MONTH
OF SEPTEMBER IN THE YEARS 1882-99.
HAVING A RECORDED WIND
FORCE OF 8 OR MORE.



LEAVES OF CYPERUS STOMES WHICH GROW
IN THE WAY OF RAILROAD DURING THE WINTER
OF WINTER IN THE YEAR 1888
MAKING A RECORD OF THE
FORCE OF A WIND



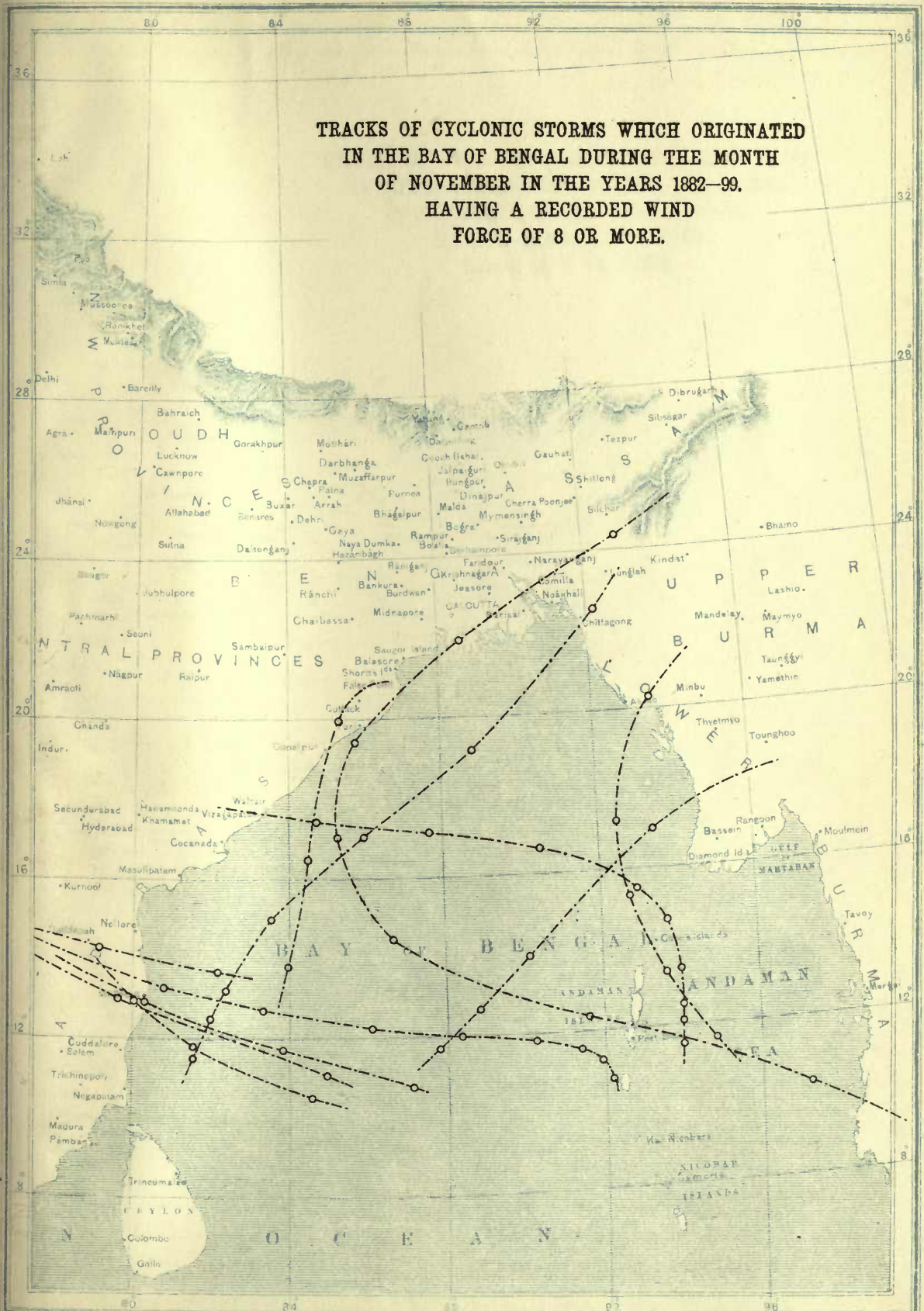
TRACKS OF CYCLONIC STORMS WHICH ORIGINATED
IN THE BAY OF BENGAL DURING THE MONTH
OF OCTOBER IN THE YEARS 1882-99.
HAVING A RECORDED WIND
FORCE OF 8 OR MORE.



RECEIVED FROM THE DISTRICT
CLERK OF THE DISTRICT COURT
IN THE MATTER OF THE ESTATE OF
JOHN J. BROWN, DECEASED
JAN 10 1900



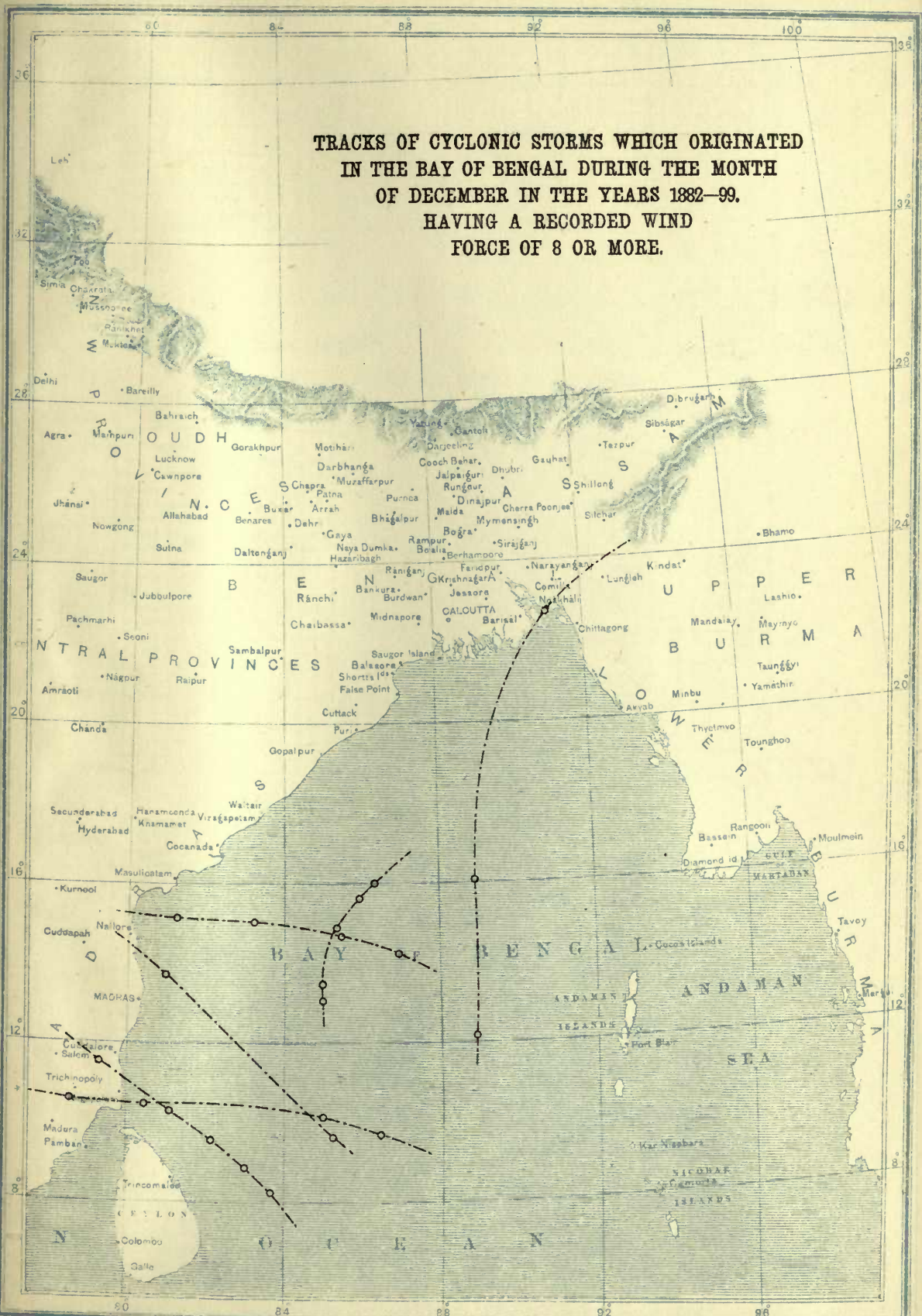
TRACKS OF CYCLONIC STORMS WHICH ORIGINATED
IN THE BAY OF BENGAL DURING THE MONTH
OF NOVEMBER IN THE YEARS 1882-99.
HAVING A RECORDED WIND
FORCE OF 8 OR MORE.



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IN THE CITY OF BERKELEY
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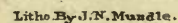
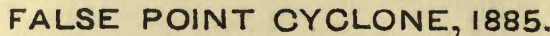
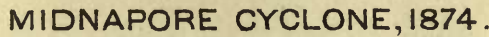


**TRACKS OF CYCLONIC STORMS WHICH ORIGINATED
IN THE BAY OF BENGAL DURING THE MONTH
OF DECEMBER IN THE YEARS 1882-99.
HAVING A RECORDED WIND
FORCE OF 8 OR MORE.**

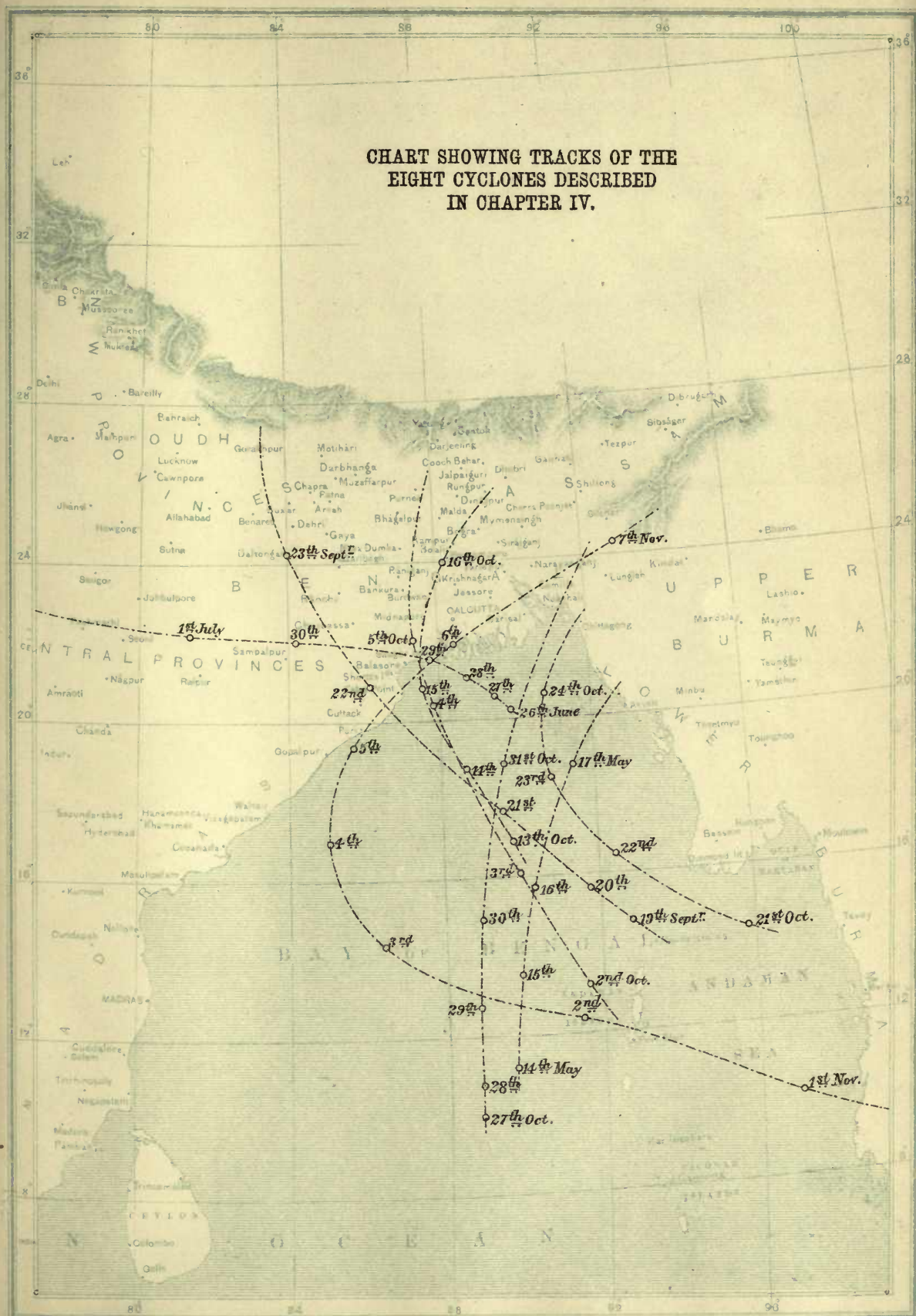


TRACES OF CLOUDS WHICH WERE OBSERVED
IN THE BAY OF BENGAL DURING THE MONTH
OF DECEMBER IN THE YEARS 1841-42
HAVING A RECORDING WIND
FORCE OF 3 OR MORE



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